

NYASALAND PROTECTORATE

Annual Report of the

DEPARTMENT of AGRICULTURE

for the Calendar Year, 1923



Printed and Published by
THE GOVERNMENT PRINTER, ZOMBA.

1924.

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THE DEPARTMENT OF AGRICULTURE,

ZOMBA,

NYASALAND PROTECTORATE.

25th June, 1924.

Sir,

I have honour to submit herewith for the information of His Excellency the Governor the annual report of the Department of Agriculture for the calendar year 1923.

I have the honour to be,

Sir,

Your obedient Servant,

E. I. WORTLEY,

Director of Agriculture.

The Honourable

The Chief Secretary to the Government,

Zomba.

REPORT OF THE DEPARTMENT OF AGRICULTURE.

1. EUROPEAN AGRICULTURE.

In compliance with the provisions of the Agricultural Statistics Ordinance, returns for the calendar year 1923 were forwarded to the Department of Agriculture by the European planters in the Protectorate, and in Appendix I will be found statistical information regarding the crops under cultivation. The figures given below show the acreages planted to the more important crops in the year 1923 as compared with the previous year and with ten years ago.

Crop.	1913.	1922.	1923.
Coffee	2,600	335	474 ³ / ₄
Cotton	25,697	26,545	20,948
Fibres	1,008	2,716	2,763 ¹ / ₂
Rubber	1,253	1,915	1,812
Tea	2,812	4,701	4,235 ¹ / ₂
Tobacco	10,499	18,554	17,308

Cotton.—Market prices were maintained throughout the year at a level that would have assured profitable returns to the growers, but unfortunately yields per acre were very low owing to the prevalence of the red bollworms (*Diparapsis castanea*) which was responsible for more damage this year than has been the case for a number of years past.

With a view to reducing the damage done by bollworms, a series of experiments were carried out by the Government Entomologist and the time of the entomologist on the staff of the Empire Cotton Growing Corporation was devoted entirely to a study of the red bollworm. Special efforts were made during the year to ensure the destruction at the end of the season of all cotton bushes. The time usually allowed to cotton growers was materially shortened and six temporary inspectors were engaged on the work of supervision.

Under present conditions the margin of profit to a European cotton grower is admittedly small, taking one year with another, and it is only by the adoption of improved methods of cultivation and by skilful management that successful results can be expected when normal prices for cotton rule on the home market.

Reference is made later to the assistance given to the cotton industry by the Empire Cotton Growing Corporation.

Tea.—It is a pleasure to be able to report, after a period of depression due to low prices, that profitable returns are again being obtained by the Mlanje tea planters. Market prices and yields have been good, and prospects for the future are bright.

New machinery has been installed in the factories, improved methods of cultivation and manufacture are being adopted and our tea planters can take justifiable pride in the fact that Nyasaland tea is fetching higher prices as compared with the product of other tea-growing countries than has previously been the case.

Tobacco.—In February of the year under review the crop promised to be a record one for the Protectorate, but the heavy rains that fell in March resulted in favourable conditions for the spread of bacterial and fungoid diseases, and yields were consequently much reduced. Market conditions, however, showed much improvement over recent years and the crops sold readily at fair prices.

Tobacco is the premier European grown crop, and in the potential possibilities of this industry the Protectorate has an asset of much value. Nyasaland tobacco, alone of Empire grown tobaccos, challenges the supremacy of certain classes of American tobacco on the English market, and no effort should be spared to strengthen the creditable position that the Protectorate has in a comparatively few years attained as a tobacco growing country.

Valuable assistance has been given to tobacco growers by the Agricultural Chemist, but there is an urgent need for the appointment of a tobacco specialist. Tobacco culture is an intricate business, and perhaps offers a more profitable field than any other crop for the services of a highly qualified expert. New problems are constantly arising with regard to the growth and curing of this crop, and it is clear that new difficulties could be more economically overcome if the growers had the guidance that could be given by a tobacco specialist.

2. NATIVE AGRICULTURE.

Cotton.—Special interest centres in the production of native grown cotton for the year 1923, as it was during this year that the much discussed agreement with the British Cotton Growing Association came into force. The annual production for the past five years is given below, and it will be noted that the tonnage of seed cotton increased from 387 tons in 1922 to 747 tons in 1923.

Year.	Seed cotton (tons).
1919	300
1920	315
1921	375
1922	387
1923	747

Comparative returns for the cotton growing districts for the years 1923 show the marked increase in the Lower Shiré and Chikwawa districts which had the benefit of the energetic services of Mr. N. D. Clegg, agriculturist. In the Lower Shiré District valuable assistance was given to Government by Mr. J. A. Lee, manager of the British Cotton Growing Association, who has done much to make a success of the new scheme for developing the native cotton industry.

Seed cotton purchased (tons).

	1922.	1923.
Lower Shiré	253	477
Chikwawa	4	75
Neno	22	48
Matope	—	5
Palombe	65	61
Ncheu	11	27
Fort Johnston	12	14
Karonga	20	30
	387	747

The native growers received £13,500 in 1923 as compared with £7,092 in 1922; but the monetary benefits are not limited to payments to natives. Government will receive a comparatively large sum as half share of the profits for the year; commissions have been paid to European buyers; the railway has profited by freight; motor transport owners and native carriers have had employment; and private companies have ginned a proportion of the cotton purchased from natives.

Tobacco.—During the year there was a marked increase in the amount of tobacco grown by natives and there is every indication that many Europeans are keenly interested in the development of the native tobacco industry. A wide extension of this industry is possible, but for some time at least close supervision will be necessary to ensure the production of tobacco of good quality.

Foodstuffs.—The privations due to the famine of the previous year led to the planting of larger areas with food crops than usual. Seasons were favourable and a bumper harvest was reaped in most districts.

3. NAMIWAWA EXPERIMENTAL STATION.

Good work was done during the early part of the year at the Government farm at Namiwawa under the management of Mr. F. Barker, agriculturist; but in August all agricultural work was abandoned and it was decided to close this station. Namiwawa has since its inception proved unsatisfactory in many respects as an experimental station and the opening by the Corporation of a cotton experimental station at Naisi makes the present time a suitable one for closing the Namiwawa station.

4. PLANT INTRODUCTION AND SEED SELECTION.

This very important branch of the work of an Agricultural Department has been in the charge of the Assistant Director, but during the year the cotton seed selection work was handed over to Mr. H. C. Sampson, cotton specialist of the Corporation.

A number of varieties of tobacco obtained through the courtesy of the tobacco division of the United States Federal Department of Agriculture were tested at Namiwawa. Seed was bagged and collected from selected plants for further trial. Experience in Southern Rhodesia indicates the value of planting local seed, and results obtained from the forty pounds of selected tobacco seed issued by the department points to the importance of such a practice being generally adopted in this country, and planters who wish to save their own seed are strongly advised to obtain the guidance of the Assistant Director in making their selections.

A large number of pulses and grains were imported from India, and some of these give promise of proving useful for growth by natives.

In view of the closing of Namiwawa Farm, arrangements are being made for carrying out tobacco seed improvement and the testing of new introductions of various kinds of plants at a site near Zomba under the supervision of the Assistant Director.

5. GOVERNMENT LIVESTOCK.

On the ground of economy, it has been decided to close the dairy at Namiwawa and to dispose of all the livestock at this station, including the imported Sussex and Ayrshire cattle. The Indian bulls and cows imported from the Government farm at Hissar are to be retained. These animals are at Fort Herald and Chiromo and have kept in good health. The half-bred progeny sired by the Indian bulls give promise of developing into animals much superior to their dams, which are native cattle.

6. VETERINARY DIVISION.

The work of the veterinary division is fully reported on by the Chief Veterinary Officer and calls for little comment on my part. The year has been free of new and serious outbreaks of disease with the exception of trypanosomiasis in cattle in the Lower Shiré district. Prompt measures were taken to prevent infection spreading to neighbouring herds.

In the report of the veterinary division interesting figures are given regarding the value of the cattle of the Protectorate and the increasing use by natives of meat as an article of diet.

My thanks are due to the Chief Veterinary Officer for undertaking during a portion of the year the management of the dairy herd and of the other livestock at Namiwawa as well as for assistance given to the officers studying the bacterial diseases of tobacco.

7. FORESTRY DIVISION.

In December, 1923, Mr. J. B. Clements, B.Sc., was, on the resignation Mr. J. M. Purves, appointed by the Secretary of State to the position of Chief Forest Officer. In a clear and detailed report Mr. Clements outlines the work of the forestry division during the year.

Few countries are as dependent as Nyasaland is on an adequate water supply and on sufficient timber and fuel, and the most valuable feature of the work of the Forestry Division for the year is the rapid progress that has been made in the demarcation of forest reserves for the purpose of conserving the forest growth and protecting the streams.

More effective control of natives is urgently needed to protect the tree growth on the slopes of hills that cannot be reasonably demarcated as reserves.

8. CHEMICAL AND BIOLOGICAL DIVISION.

The report of the Agricultural Chemist is appended and shows that the greater part of his time was devoted to work in connection with the tobacco industry. A large number of tobacco soils have now been examined and the fertiliser experiments started in 1920 have been continued. As a result valuable information has been accumulated regarding the most economical use of fertilisers and bearing on other problems connected with the cultivation of tobacco. During the year the Chemist prepared a series of articles that were published in the *Nyasaland Times* or issued by the department.

REPORT OF THE GOVERNMENT ENTOMOLOGIST.

The report of the Government Entomologist, and his notes on the seasonal history of the bollworm and on the results of his field experiments in methods of controlling this pest will in particular be read with great interest by cotton planters.

The Government Entomologist has since his arrival in the Protectorate undertaken the mycological work of the department in addition to his other duties, but at his request arrangements have been made for the Assistant Director to deal with plant diseases in future.

An important series of circulars and leaflets on the control of insect pests and a bulletin on plant diseases were prepared by the Government Entomologist who also contributed a number of articles to the press.

9. EMPIRE COTTON GROWING CORPORATION.

As stated in my last report, Mr. H. C. Sampson, C.I.E., B.Sc., cotton specialist of the Empire Cotton Growing Corporation, and his assistant, Mr. H. C. Ducker, arrived in the Protectorate in December, 1922. In the year under review the corporation staff was augmented by the arrival of Captain C. R. King, entomologist, and Mr. E. S. Eldridge, farm superintendent.

During the year the Corporation opened a cotton experimental station at Naisi. Rapid progress was made in clearing the timber and getting the land under cultivation as well as in the putting up of buildings. The main work at the station will be the testing of local and imported selections of cotton with a view to the building up of improved strains for general distribution.

The Corporation Entomologist is devoting his time to a study of the red bollworm and other cotton pests.

The advantages to be gained from the services of Mr. Sampson and his staff are fully appreciated by the Government and the planting community, and the Protectorate is under a deep debt of gratitude to the Corporation for the generous assistance rendered to the cotton industry.

10. AGRICULTURAL CONFERENCE.

An Agricultural Conference was held in August at Blantyre at which His Excellency the Acting Governor was present. The chair was taken by Mr. A. F. Kidney, President of the Chamber of Agriculture and Commerce.

The objects of the Conference were two-fold: (1) to give planters an opportunity of putting before His Excellency matters of importance with regard to which they desired the assistance of the Government, and (2) to enable the officers of the Department of Agriculture to briefly outline the nature of the work on which they were engaged.

There was a gratifying response to the invitations sent out and there was a large attendance of planters representing all the branch associations of the Chamber of Agriculture and Commerce. Land tenure, forestry conservation, registration of labour and other matters were discussed and papers were read by officers of the department and by the Geologist.

11. PUBLICATIONS.

During the year the following bulletins and publications were issued by the Department:—

- | | |
|---|---|
| Circular No. 2. Spraying Tobacco Seed-beds. | Circular No. 4. Tobacco Beetle. |
| 3. Manuring the Tobacco Crop. | 5. Management of Tobacco Seed-bed Soil. |
| Leaflet A. Sterilization of Tobacco Seed. | Leaflet F. Poison Baits. |
| B. Fumigation with Hydrocyanic Acid Gas. | G. Arsenical Sprays. |
| C. Eelworm or Root Gallworm. | H. Paraffin Emulsion. |
| D. Value of Manures. | J. Tobacco Extracts. |
| E. Soil Type A. | Bulletin 3. Plant Diseases. |

Circulars 2 and 4, Leaflets A, B, C, F, G, H and J and Bulletin 3 were prepared by the Government Entomologist, and Circulars No. 3 and 4 and Leaflets D and E were prepared by the Agricultural Chemist.

The value of the majority of the departmental publications depends in a large measure on their timely issue at the season when the advice they contain should be put into practice by the planter, and it is to be regretted that the department has so much difficulty in arranging for the printing of articles prepared by its technical officers.

Original or adapted articles of interest to the planting community were from time to time contributed to the *Nyasaland Times*. The Government Entomologist was in charge of this service.

STAFF.

Mr. J. M. Purves, Chief Forest Officer, went on leave in March 1923 and retired after twenty-two years service in the Protectorate. Mr. J. B. Clements, B.Sc., acted as Chief Forest Officer until the date of Mr. Purves's retirement when he was appointed to fill the position of Chief Forest Officer.

The following officers were absent on leave during the year: Mr. E. W. Davy, Assistant Director, from 13th October to 31st December; Mr. J. de Meza, Veterinary Bacteriologist, from 1st January to 3rd November; Captain J. M. Culhane, Veterinary Officer, from 18th August to 31st December; Mr. F. Barker from 3rd August to 31st December; Mr. E. Grove-White from 13th May to 31st December; Mr. A. C. Stewart, accountant, from 2nd April to 1st December; and Mr. J. L. Gamble, clerk, from 31st October to 31st December.

As I mentioned in my last annual report it was only in 1921 that the staff of the department was brought up to a strength that would enable it to cope at all adequately with the many difficulties that confront the planting community. The work of the year under review has been handicapped to some extent by the pressing need for effecting economies in all branches of the Government service, but I take great pleasure in reporting that the officers of the department have taken the keenest interest in their duties and have accomplished much useful work.

EUROPEAN AGRICULTURE, 1923.

Name of District.	Total Acreage under cultivation. Acres.	COTTON.		TOBACCO.		MAIZE.		TEA.		COFFEE.		CECRA.		RUBBER. PARA.		CHILLIES.	
		Acres under crop.	Yield cwt.	Acres under crop.	Yield cwt.	Acres under crop.	Yield cwt.	Acres under crop.	Yield cwt.	Acres under crop.	Yield cwt.	Acres under crop.	Yield lbs.	Acres under crop.	Yield lbs.	Acres under crop.	Yield cwt.
Lower Shire	5,217 $\frac{1}{2}$	3,065	1,243	...	...	269	1,602	...	...	...	...	...	...	...	...	...	...
Chikwawa	6,350	5,930	3,294	...	...	250	1,920	...	...	...	...	...	...	...	...	20	30
Central Shire	770 $\frac{1}{4}$	177	600	528	1,410	48	620	...	...	...	...	...	...	...	...	...	...
Cholo	13,356	1,665	117	7,342	14,512	1,144	11,206	487	824	30	...	...	...	...	...	1	1
Mlanje	7,069	1,182	1,460	1,315	2,188 $\frac{3}{8}$	360	3,385	3,748	8,111	...	...	...	...	...	...	38	150
Blantyre	5,219 $\frac{1}{2}$	335	84 $\frac{1}{2}$	3,060	5,910	627	5,445	...	...	200	245	310	...	...	...	$\frac{1}{2}$	...
Chiradzulu	2,480	300	36	1,201	2,430	205	2,020	...	...	...	...	...	...	...	...	...	...
Zomba	7,411	4,473	1,874	2,097	4,942 $\frac{3}{8}$	474	6,860	...	...	11	...	...	...	...	...	...	...
Upper Shire	430	426	122	...	...	4	40	...	...	...	...	...	...	...	...	...	...
South Nyasa	822	25	...	645	1,596	51 $\frac{1}{2}$	209	...	...	1	...	...	...	...	...	...	...
Ncheu	2,557 $\frac{1}{2}$	1,385	265	788	1,375	127	2,060	...	...	231	743	...	...	...	...	...	...
Dedza	706	520	280	42	58	33	640	...	...	...	...	...	...	...	...	1	...
Fort Manning	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Lilongwe	311 $\frac{1}{2}$	3	...	290	566	6	85	...	...	...	...	...	...	...	...	...	...
Dowa	22	3	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Kota Kota	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Kasungu	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Mombera	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
West Nyasa	1,573	15	17	...	...	...	...	...	...	...	...	...	...	...	...	25	25
North Nyasa	2,221	1,444	538	...	...	251	4,212	...	...	1 $\frac{3}{4}$	1 $\frac{3}{4}$	...	...	...	...	...	...
Total	56,516 $\frac{1}{4}$	20,948	9,932 $\frac{1}{2}$	17,308	34,988	3,849 $\frac{1}{2}$	40,304	4,255 $\frac{1}{2}$	8,935 $\frac{1}{2}$	474 $\frac{3}{4}$	989 $\frac{3}{4}$	310	...	1,502	125,070	85 $\frac{1}{4}$	206

EUROPEAN AGRICULTURE, 1923.—Continued.

Name of District.	CAPSICUMS.		FIBRES.		BEANS.		GROUNDNUTS.		WHEAT.		FODDER AND FORAGE CROPS.		TIMBER AND FIREWOOD.		ENGLISH POTATOES.		MILLETS.	
	Acres under crop.	Yield cwt.s.	Acres under crop.	Yield cwt.s.	Acres under crop.	Yield cwt.s.	Acres under crop.	Yield cwt.s.	Acres under crop.	Yield cwt.s.	Acres under crop.	Yield cwt.s.	Uncultypus.	Others.	Acres under crop.	Yield cwt.s.	Acres under crop.	Yield cwt.s.
Lower Shire	3	10	1,665	7,091	21	21	...	...	5	4	210	...	...	...	...	...	...	...
Chikwawa	...	...	...	...	...	...	...	...	...	...	...	...	...	...	150	...	1,200	...
Central Shire	...	...	...	...	10	15	...	...	...	...	...	...	5	21	...	...	...	...
Cholo	...	...	1,098	3,395	371	538	...	...	2	...	...	...	1,127	89	...	...	...	...
Mlanje	...	...	...	...	168	206	...	...	8	22	...	...	130	120	...	...	...	...
Blantyre	15	61	...	...	97	102	...	...	3	30	30	80	522	201	...	...	...	...
Chiradzulu	5	...	...	...	479	371	...	...	...	...	...	...	287	3	...	...	...	...
Zomba	...	...	...	...	211	438	9	48	6	15	...	...	75	55	...	...	...	...
Upper Shire	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
South Nyasa	...	...	...	...	39	72	2	9	2	51	61	...	34	151	...	...	...	...
Nchen	...	...	...	...	8	30	...	...	2	2	61	25	2	5	...	...	...	...
Dedza	...	...	...	...	45	160	13	34	22	98	...	...	21	9	...	...	...	...
Fort Manning	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Lilongwe	...	...	...	...	21	2	...	...	...	...	...	...	...	10	...	...	...	...
Dowa	...	...	...	...	...	...	...	...	12	88	2	...	3	2	...	...	...	...
Kota Kota	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Kasungu	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Mombera	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
West Nyasa	...	...	...	...	1	2	...	...	...	...	...	...	...	30	...	...	...	...
North Nyasa	...	...	...	...	150	1,350	11	10	131	1,000	...	...	152	88	1	...	14	...
Total	23	161	2,763	10,486	1,582	3,388	231	101	193	1,265	255	115	2,358	449	3	...	151	1,214

NATIVE AGRICULTURE, 1923.

NOTE.—Maize is the staple foodstuff in most districts, but no estimate can be given of quantities grown. Groundnuts and beans are grown in various parts.

LIVESTOCK OWNED BY EUROPEANS AT 31ST DECEMBER, 1923.

District.	Cows and Heifers over 1 year.	Bulls.	(Xen.)	(Natives)	Pedigree Cattle.	Horses.	Mules.	Donkeys.	Sheep, European.	Sheep, half-bred.	Sheep, native.	Pigs.	(Tons)
Lower Shire	822	39	610	280	...	...	...	1	...	10	96	9	113
Chikwawa ...	399	10	340	181	...	...	...	9	...	...	70	22	13
Central Shire	...	...	...	...	...	...	...	...	...	...	12	...	9
Cholo ...	968	22	892	335	...	...	...	20	...	39	114	98	376
Mlanje	608	24	803	310	3	...	...	...	...	17	159	12	133
Blantyre	1,626	29	992	873	12	2	...	20	...	1	91	280	141
Chiradzulu	283	7	321	123	...	...	...	20	...	...	52	116	17
Zomba ...	883	12	968	503	21	...	...	50	20	...	85	86	...
Upper Shire	...	...	...	...	...	...	...	...	...	...	...	...	...
South Nyasa	109	4	50	60	...	...	...	2	...	...	91	2	173
Ncheu ...	433	12	237	103	...	2	...	...	...	30	96	221	45
Dedza ...	270	6	306	86	...	...	1	45	21	...	23	231	14
Port Manning	...	...	...	...	...	...	...	...	...	...	...	...	...
Lilongwe	204	4	139	7	...	...	...	9	...	...	10	23	13
Dowa	106	2	135	92	...	...	...	33	...	...	65	51	44
Kota Kota	...	...	...	...	...	...	...	...	...	...	...	...	...
Kasungu	...	...	...	...	...	...	...	...	...	...	...	...	...
Mombera	...	...	...	...	...	...	...	...	...	...	...	...	...
West Nyasa	...	...	...	...	...	...	...	...	...	...	...	...	...
North Nyasa	92	6	106	44	...	...	...	2	...	...	83	36	...
Total	6,814	201	5,942	3,002	7	4	14	202	22	147	1,082	1,331	1,150

NATIVE LIVE STOCK, AS AT 31ST DECEMBER, 1923.

District.	Cattle.	Live Stock.		Pigs.
		Sheep.	Goats.	
Lower Shire	165	1,000	6,050	7,000
Chikwawa	67	848	2,664	2,809
Central Shire	355	1,029	9,011	456
Cholo	128	440	2,284	1,260
Mlanje	—	450	3,000	1,500
Blantyre	515	632	6,107	2,327
Chimadzulu	1,088	1,224	7,260	1,954
Zomba	275	1,200	7,000	150
Upper Shire	7	800	7,200	—
South Nyasa	647	12,412	11,354	—
Ncheu	4,500	4,500	12,500	2,500
Dedza	5,255	4,829	24,495	3,925
Fort Manning	1,174	3,213	3,381	857
Lilongwe	10,500	14,000	38,000	4,000
Dowa	14,056	7,000	35,100	140
Kota Kota	1,450	2,000	2,000	30
Kasungu	3,900	360	3,000	300
Mombera	27,000	7,200	1,000	180
West Nyasa	4,200	850	1,800	—
North Nyasa	26,739	616	1,127	—
Total	102,021	64,603	183,933	28,225

CROPS.			LIVESTOCK.	
Nature of crop.	Number of acres under cultivation.	Gross quantity of produce (for local consumption and export).	Nature of livestock	Number.
<i>European and Native Agriculture.</i>	*	Cwts.	<i>European and Native Livestock.</i>	
Wheat	193	1,265 $\frac{1}{4}$	Horses	4
Cotton	20,948	9,932 $\frac{1}{2}$	Asses	202
Fibres	2,763 $\frac{1}{2}$	10,486 $\frac{1}{2}$	Mules	14
Maize	3,849 $\frac{1}{2}$	40,304	Horned cattle	117,987
Potatoes	3	...	Sheep	66,574
Coffee	474 $\frac{3}{4}$	989 $\frac{3}{4}$	Goats	185,083
Beans	1,582 $\frac{1}{2}$	3,288 $\frac{1}{2}$	Pigs	29,556
Tea	4,235 $\frac{1}{2}$	8,935 $\frac{1}{2}$		
Millet	151	1,214		
Tobacco	17,308	34,988		
Rubber (plantation)	1,812	125,070 lbs.		
Chillies	85 $\frac{1}{4}$	206		
Groundnuts	25 $\frac{1}{4}$	101		
Capsicums	23	16 $\frac{1}{2}$		

* Does not include acreage under cultivation by natives.

VETERINARY.

During the year under review the necessity of economising on the general expenditure of the Protectorate has led to reduction of staff and also the funds for carrying out the normal services of the veterinary staff. Three Indian veterinary assistants have been replaced by one European stock inspector, and proposals for extending the scope of the services provided have necessarily been considerably curtailed.

There have been no serious outbreaks of epizootic diseases during the period which this report covers. The only heavy losses have been occasioned by outbreaks of trypanosomiasis, due to the constantly changing areas into which tsetse fly are spreading and the need as the country develops for utilising animals, even in areas where it is dangerous to keep them or even to allow them to pass through.

"East Coast Fever" has remained under control during the past twelve months in the Southern Province, there having been only one death, during February, from this disease, in the last existing outbreak outside the areas in which the disease is enzootic. This result is due almost entirely to the European owners of cattle having very willingly aided the authorities in carrying out the measures required to control this disease, by regular dipping and the proper maintenance of the dipping solution. The effect of the more widespread adoption of regular dipping is made noticeable by the almost entire cessation of outbreaks of demodectic mange and other skin diseases in the Southern Province, these being still prevalent in the Northern and Central Provinces.

The inter-provincial trade in cattle, sheep and goats in the Protectorate has been rather above the normal in volume during the past year, this being in some measures due to the famine in the early part of the year, which caused an increase in the amount of meat consumed in all the famine areas, but in addition there is also a noticeable tendency on the part of the natives of the Southern Province to become owners of cattle, particularly those natives who, being skilled artisans, clerks, etc., have some surplus money to invest. In spite of what would appear to amount to a surplus of cattle in some districts and that there have been very few cases in which there was difficulty in selling cattle in the Southern Province, except when exorbitant prices were insisted on, there has been evident a lack of any economic necessity for the natives of the Northern Province to undertake a lengthy journey to bring their surplus cattle down for sale in the areas of European settlement, things being apparently so flourishing in the Momberas district that headmen stated that their people are able to dispose of the meat from their surplus male cattle locally, to natives returning in affluent circumstances from a period spent in working in Rhodesia, where wages are so much higher than in Nyasaland. A great many more cattle could be disposed of in the Southern Province if it were possible to obtain cows and heifers, but it is not a practice of the cattle-owning natives to dispose of these, except when they feel certain that the animal is barren.

The position regarding livestock in Nyasaland at the present time is that we have little more than our normal requirements for the food of our proportionally large native population, with what is required in addition by the European settlers for work oxen and dairy stock. It would be impossible at the present time for any person to purchase large mobs of cattle for export at anything like a price at which it would pay to drive animals down to any market in the south, as was the custom some fifteen years ago. Our cattle-owning natives, particularly the Wankonde, would be in a parlous condition without their cattle. The possession of cattle forms such an integral part of their tribal life that it would be difficult, without entirely revolutionizing their tribal customs, for them to carry on their present mode of life without cattle, and of these the cow in particular. Milk products are staple articles of their diet, and the possession of one cow at least is necessary before any young man can legally obtain a wife.

In the areas in which Europeans have settled, the demand for skilled native artisans of various kinds, with increased facilities for native trading, as well as the growth of such economic crops as tobacco and cotton by natives, gives employment to natives at more remunerative salaries, and there is thus a yearly increase in the number of natives who can afford to buy meat. The advance in financial circumstances attained by these skilled natives makes them appreciate a more comfortable mode of living than is adopted by their less civilised brethren, and as a result one finds this reflected in the diet. The villager lives on the products of the soil along with what may come his way, as a gift from heaven, in the form of meat, while those more affluent persons are becoming accustomed to, and, in fact, finding a necessity for meat as an article of their normal diet. The increase in the consumption of meat by natives will cause a demand for a greater number of cattle, sheep and goats by the people of the Southern Province, with advantage mainly to the Central Province, which supplies the majority of livestock now brought into the Southern Province for sale. A further means by which any surplus can be absorbed for some years to come is the increasing demand for work oxen by European settlers. Labour in the form of the local native is becoming sufficiently educated to realise that he may as well work for himself or go abroad, as hire himself to a local employer who pays him a small wage and is ever seeking rather a bigger task for the pay, while the price of cloth, demanded by the worker's wife as well as for clothing himself, shows no sign of falling. As a result, it is becoming more and more necessary for the erstwhile cheap native labourer to be replaced where possible by the cheaper work ox.

It has taken a long while for Nyasaland to get down to the facts, but boom prices in tobacco and cotton are likely to be things of the past for the small man, and syndicates or companies will have to get down to the hard facts of relative values to obtain profits with the dearer native labourer of the future. These factors will mean the more general adoption of the cheapest available efficient labour, the ox, and a much greater extension of the use of work animals generally, oxen as well as donkeys in particular, for transport and work on the land.

All the above-mentioned points are facts which make cattle and other livestock of greater local value to Nyasaland than they could ever be if the country depended on the production and sale of livestock for its outside source of wealth. Fortunately this is not the case, and what we have we can value more highly for being available for our use in producing more wealth by other means, if the proper advantage is taken of this asset. These means have not been fully exploited in the past, but they are available for our future needs whenever we are forced to adopt them.

It would be a shock to any farmer in Great Britain or other parts of Europe to realise the extent to which the use of manure of cattle or any other fertiliser has been neglected in Nyasaland for fertilising the soil. The time is already here when we must consider and apply the means we have for utilising the knowledge, obtained by bitter experience in other countries, regarding, fertilisers and the rotation of crops. Livestock are an integral part of any such system of farming and without them the cultivation of the soil would show little profit.

CONTAGIOUS DISEASES

Rinderpest.—The precaution adopted on our northern border of maintaining a "control area," in which the movements of stock are controlled and all cattle registered, is being carried on. Towards the latter end of the year the disease had spread a considerable distance south of the Central Railway in Tanganyika Territory owing to illicit movements of cattle by natives, and, in spite of the vigorous efforts of the veterinary department of that territory, had spread by the end of the year to the Ruaha river, some 150 miles from our border. At the time of writing the disease is reported to be well in hand, and the Ruaha river owing to the rains is impassable for cattle. The situation is considered to be satisfactory for the present so far as any southward spread of the disease is concerned.

Trypanosomiasis.—We have more to fear from this disease as a hindrance to the development of the Protectorate as a whole than any other disease, political condition, or change in market values of the raw products which we can produce. Our greatest losses of livestock, and these cannot be fully estimated with our present veterinary staff, are undoubtedly due to this disease. There is so much in the way of research required into the extent to which this disease is causing losses both of man and his domestic animals which has not been investigated, that the real significance of the losses which we incur are not realised. The economic losses as a result of the constant necessity for the movement of the population of the affected areas and the losses of livestock, apart from the shutting off of the routes by which they may reach a market, are more serious conditions than have so far been attributed to the extensions of tsetse fly in Nyasaland. The extent of country which is developed represents less than one-third of the total, and of the remainder at least one-half is uninhabited; a great part of this, probably at least one-third, being due to the presence of tsetse fly and the consequent inability of natives, who depend a great deal on livestock, to maintain any animals. This state of affairs can only be overcome by the agricultural development of the areas infected by tsetse fly. The clearing of indigenous forest, scrub and bush as civilisation extends will drive back the tsetse fly in time, and at present offers the only remedy to the extinction of this pest in the sparsely populated areas. Motor transport while being a boon, and indispensable to the development of some parts of the Protectorate, has been a means of disseminating tsetse fly and actually in this way causing animals to become infected with Trypanosomiasis in areas otherwise free from such a source of infection.

During the year losses from this disease have occurred in North Nyasa, Mombera, Kasungu South Nyasa, Ncheu, Blantyre, Zomba and the Lower Shiré districts, these being the only known outbreaks; there are many others in which these parasites could possibly have caused the losses which have occurred in other districts, in areas outside the scope of the small staff available for investigating outbreaks of disease among animals. During the year nearly 400 head of cattle have been treated for Trypanosomiasis, the method of treatment being intravenous injections of potassium antimony tartrate in normal saline. The method of treatment is only satisfactory as a means of keeping animals in an emergency for a limited period in a tsetse fly infested zone, but is of value for the treatment of animals in an area where re-infection can be prevented. Two dogs treated for infection by *T. Brucei* recovered after treatment with Bayer 205. No case of natural infection has been recorded in sheep, goats or pigs.

Tuberculosis.—The only cases recorded in the present year are among the cattle of an old-established firm in a township, and there seems little doubt that these cases have become infected by organisms derived from human sources, a large number of animals being grazed over pastures which extend up to the dwelling houses and the cattle also housed in conditions during their early life approximating to those known to be ideal for culturing this disease—lack of air and light with the usual appurtenances of buildings which have no provision for carrying out effective sanitary measures. It is surprising that tuberculosis is not more common among our cattle, particularly the cattle of such natives as the Wankonde in North Nyasa, who have their cattle living in the same huts as themselves. Possibly it may be due to the fact that these natives are not so frequently affected with the disease, being less inclined to emigrate in search of work, while the natives who are more likely to have become infected, while working in Rhodesia or South Africa, are those who invariably keep their cattle in enclosures without any roofs. Only one case of tuberculosis of cattle has been recorded outside the areas of European settlement (the Southern Province), and that was in North Nyasa in an animal from the Mombera district during 1916.

Tick-borne diseases (Cattle, Sheep and Goats).—"Tropical piroplasmosis" (*T. Mutans*), "East Coast Fever" (*T. parva*), "Red Water" (*B. bigeminum*), as well as *B. ovis* infections, have not been a cause of any epizootic during the past year. The three last mentioned are enzootic in the greater part of the Protectorate while "East Coast Fever" has been confined to the enzootic areas, which, for purposes of controlling the disease, are defined as the whole of the Northern and Central Provinces. In the Southern Province the disease "East Coast Fever," which occurred in epizootic form in 1921, has remained under control, and at the present time there is only one centre in which a death has taken place from this disease within the past twelve months. In the enzootic areas this disease is reported to have caused fewer deaths than usual among the calves and animals under one year, to which the losses are practically confined. Dipping is compulsory in the Southern Province, and there are only isolated small herds which have no dipping facilities. There are now 67 dipping tanks available in the Protectorate, and of these 62 are in the Southern Province, being used by approximately 19,000 head of cattle.

The experience of Nyasaland has again demonstrated what has already been proved in other countries—the value of dipping livestock in arsenical solutions as a means of controlling ticks, and in this way preventing the spread of the diseases which these parasites pass on from sick to healthy animals. Our losses in the Southern Province from the general run of tick-borne diseases have been reduced in the herds which have dipping facilities to a point at which they are no longer a factor of any importance, and the general condition of animals is so much improved that the cost of the dipping is more than paid for in their enhanced value, apart from it now being possible to import breeding stock to improve our native livestock.

Skin Diseases.—Demodectic mange of cattle has only occurred in a few sporadic cases in various parts of the Protectorate, and the same applies to *Streptothricosis* (tropical dermatitis). All the animals found infected with the former disease were slaughtered, and the justification of this policy is proved by comparison of the numbers it was necessary to slaughter during 1914-15 as compared with the past year.

During the rains lesions caused by mud drying on the bodies of animals confined at night in badly-drained enclosures, the earth floors of which have become simply a mass of puddled clay, give rise to losses owing to the reduction in the amount of milk produced; the inability of work animals with severe lesions, involving necrosis of the skin, to carry out their tasks; and, also, the deaths which may occur from septicæmia and shock as a result of the very extensive areas of skin which slough away, leaving large portions of the subcutaneous tissues exposed to infection.

Scabies in cats, dogs and pigs have been frequently reported, but the condition appears to be rare amongst the native sheep.

Myiasis.—The larva of a species of cordylobia (the mputsi fly) often infects dogs, cats and particularly young animals, causing abscess formation in the skin.

The Seasonal Gastro Enteritis of Cattle known as "grass sickness" was a cause of a great deal of sickness among cattle during the rains, the rate of mortality not being very high in the majority of the herds affected, although the economic loss in the milk of cows and the work of draught oxen which become ill is of considerable importance. Experiments carried out in the treatment of the condition show that the best results are obtained by *avoiding the use of purgatives* and dosing with solutions of potassium permanganate. Doses of this salt varying from 15 to 60 grains with half to two ounces of common salt in one to four quarts of water, along with normal saline enemata, have given the best results and definitely cut short an attack of the disease, if the owner recognises the early symptoms in which mucus appears in the diarrhoeal fæces or is seen coating the firm dung passed in the later phase. Apparent stiffness in the gait is usually noticeable, with a tendency in most cases to lie down at every opportunity. Later there is constipation, particularly in the unfavourable cases, with perhaps only a small amount of mucous being evacuated, often tinged with blood. Animals that die of the disease show severe lesions of either *gastritis*, *enteritis* or *gastro-enteritis*, the mucous lining of the true stomach and the intestines in the parts affected being acutely inflamed.

Anthrax.—Only four cases have been reported in two separate outbreaks among cattle.

Blackquarter.—An unconfirmed outbreak was reported in the North Nyasa district in which several deaths occurred.

Anaplasmosis.—The parasite which causes this disease is frequently demonstrated in blood smears forwarded for examination, but its pathogenic effect does not appear to be of any economic importance among the native cattle as they all appear to have a tolerance to infection.

Distomiasis of cattle, sheep and goats is very common but only rarely appears to cause heavy losses. The greatest number of deaths occur during the rains among animals that are being moved from one district to another. Cattle are more often found to be infected than sheep, while the livers of goats are only rarely infected with these parasites.

Tænia Hepatica infestations of the livers of sheep and goats are very common; in fact the livers of the majority of sheep (75 per cent.) and over (50 per cent.) of the goats slaughtered are found to be infected. The lungs of all animals whose livers are infected with this parasite have lesions which appear to be associated with the same parasite, varying from red and grey infarcts to extensive hepatization, and in approximately 2 per cent. of these cases a septic pneumonia is noted.

Heart water of sheep and goats.—No outbreak has been recorded during the year.

Coccidiosis of Cattle.—No case has been recorded during the year.

Foot and Mouth Disease.—No case has ever been recorded in the Protectorate.

Glanders.—No case has ever been recorded.

African Horse Sickness.—No case has been recorded during the year.

Ulcerative Lymphangitis.—No case has been recorded during the year.

Sheep Pox.—No outbreak was recorded during the year.

Goat Pox.—One outbreak occurred in the Southern Province.

Swine Fever.—Outbreaks were reported from the Fort Manning district early in the year, but the disease was brought under control by administrative measures without difficulty.

Diseases of Dogs.—Canine typhus, piroplasmosis, and distemper were frequently reported during the year throughout the Protectorate; often appearing in enzootic form among the native-owned dogs in the villages as well as among those of imported breeds in the townships. Trypanosomiasis has been a cause of deaths among dogs in areas bordering on or within tsetse fly belts. Several cases of rabies have been diagnosed in the Southern Province.

Diseases of Poultry.—Fowl cholera, bacterial diarrhoea of fowls, aspergillosis in ducks, contagious epithelioma in turkeys and fowl diphtheria were the diseases most frequently reported during the year.

LIVESTOCK.

The official returns of Livestock for the year ending December 31st, 1923, are as follows:—

	Mules	Horses	Donkeys	Cattle	Sheep	Goats	Pigs
European owned ...	3	6	190	16,631	1,378	1,023	1,551
Native owned ...	—	—	—	102,021	64,603	183,923	28,225
Totals ...	3	6	190	118,652	65,981	184,956	29,776

In addition to the efforts of private individuals in the past to improve the native livestock of the country the Government has during past four years imported breeding stock from England and India. The following breeds were represented:—Aberdeen Angus, 2 bulls and 1 heifer; Ayrshire, 2 bulls and 1 heifer; Sussex, 2 bulls and 1 heifer. India Zebu Hissar Breed, milk strain, one bull and one cow; working strain, two bulls and two cows. Berkshire pigs, one boar and two sows. Several Africander bulls have also been imported from South Africa. The results have been quite satisfactory in so far as offspring are concerned. Of the cattle imported from Great Britain the Sussex have given the best results, closely followed by the Aberdeen Angus, while the Ayrshire is a close third; and although it is too soon to give a conclusive opinion there is little doubt that the two first breeds mentioned are more suited to our conditions and produce better offspring in crosses with our native stock than the Ayrshire. Our present requirements are more those of a type suited for working purposes than meat or milk, and on that account the build of the Sussex and the Aberdeen Angus with their natural hardiness make them more suited to our purpose. A moderate milker suffices for our present needs, so that except for those who specialise in the production of dairy products we have to aim at the class of animal which, while improving our milk yields, gives us a more powerful type of work animal while retaining the natural resistance of the native cattle to our indigenous diseases. A good milker or work animal which is unable to resist our indigenous diseases is a burden which is soon a loss, and is finally a memory of infinitely less value than half-a-dozen disease-resistant native animals who, while incapable of giving as much milk or work according to the sex, can survive the local conditions of disease and shortage of food available. We require animals which can live on the indigenous grasses and fodder crops. Animals that can produce more milk when fed properly can be bred from the native cattle by selection alone, but this is not often attended to in the rush of other quicker means of making money, and consequently we have not a great number of native cows showing improved milk yields. During the past year six bulls and three heifers of the Friesland breed have been imported from Southern Rhodesia by persons interested in milk production, and these animals appear to be well suited to conditions in the areas of European settlement.

WORKING OF VETERINARY DIVISION.

There were four officers on duty throughout the year, the Veterinary Bacteriologist was on leave until November and one Veterinary officer proceeded on leave in August. The Chief Veterinary Officer and one veterinary officer were on duty throughout the whole year. One European stock inspector replaced three Indian veterinary assistants who were retrenched. The total actual expenditure on veterinary services for the financial year ending March 31st, 1924, was £4,679 2s. 8d., and the revenue during the same period was £445 4s. 0d.

The Chief Veterinary Officer, in addition to his administrative and advisory duties, carried out the duties of the Veterinary Bacteriologist who, on his return from leave in November, 1923, took over the duties of veterinary officer to the Southern Province. During the year 804 separate laboratory examinations were carried out at the veterinary laboratory at Zomba, and in addition field experiments in the treatment of trypanosomiasis, distomiasis and "grass sickness" of cattle. The number of letters dealt with in the office of the Chief Veterinary Officer during the year ending December 31st, 1923, was 3,195, excluding permits for movements of animals received and issued as well as accounts for dipping dues and drugs sent out.

There were ten dipping tanks being directly supervised by and maintained from the funds provided for veterinary service; nine of these are in the Southern Province. The following are the numbers of animals which passed through the Government dipping tanks during the year 1923: cattle, 64,394; sheep and goats, 965; dogs, 16; total, 74,061. In addition to the Government dipping tanks there are 57 privately-owned dipping tanks. These are inspected by the veterinary staff and periodically samples of the solution are analysed.

Livestock quarantine stations are maintained at Zomba and Blantyre to deal with the animals brought down from the Northern and Central Provinces and also those from the South Nyasa district. The following figures represent the number of animals which passed through the quarantines: Blantyre, 1,703 cattle and 4,349 sheep and goats; Zomba, 793 cattle and 2,274 sheep and goats; total, 2,496 and 6,623 respectively.

The revenue derived from the Government dipping tanks and quarantines amounted to £445 4s. 0d., the native-owned cattle being dipped free of charge in the Southern Province. The expenditure on African staff, including office and field staff, was £444 18s. 2d. The upkeep of dipping tanks and quarantines (less African staff, which is included above) was £173 8s. 5d.

J. A. GRIFFITHS,
Chief Veterinary Officer.

FORESTRY.

1.—FOREST AREAS.

Demarcated Forest.—The proclaimed forest reserves existing at the end of the year were as follows:—

Name.	District.	Approx. area.	Date of Proclamation
1. Zomba Mountain ...	Zomba ...	10 sq. miles ...	1913
2. Dzalanyama ...	Lilongwe ...	470 do ...	1922
3. Kanjedza ...	Blantyre ...	512 acres ...	do
4. Ndirande ...	do ...	7 sq. miles ...	do
5. Soche ...	do ...	1½ do ...	do
6. Fort Alston ...	Kasungu ...	1,140 do ...	do
Total ...		1,629 sq. miles	

Beacons require to be erected on portions of the boundaries of these reserves although they are now fairly well known to the natives residing in their vicinity.

Undemarcated Forest.—Sufficient information is not yet available to allow of a computation of the total area of undemarcated forest in the Protectorate. The approximate distribution of forests is known to a great extent, but these being mostly of the open and poor dry type, there is usually extensive and scattered native settlement throughout them. Consequently, a very careful examination of forest tracts is necessary to obtain a true idea of their area and comparative value. Forest officers are collecting as much data as possible when passing through districts and when examining tracts with a view to reservation.

Forest Divisions.—Every effort is being made to effect decentralization of the work. With the staff as at present sanctioned it is only possible to form two forest divisions, namely, a northern and a southern. At present only a provisional allotment of administrative districts to each of these has been made. As the work of the department develops and extends, particularly in the northern portion of the Protectorate, a revision of the divisions will be necessary.

The two territorial forest divisions as at present provisionally constituted, are as follows:—

Name of Division.	Headquarters.	Territory
Southern ...	Limbe ...	Southern Province with the exception of South Nyasa District, and Zomba District.
Northern ...	Fort Johnston ...	South Nyasa District, Central Province, and Southern portion of Northern Province.

Note.—Zomba District is administered by the Chief Forest Officer from Headquarters at Zomba. As the Forest Officer Southern Division has not yet been provided with an office, all accounting, issue of permits and licences, collection of revenue, etc., has to be done in Zomba.

2.—EXAMINATION OF NEW TRACTS.

From May to December the work was largely concentrated on the examination of some of the more important watersheds with a view to their reservation. Thirteen of these were closely examined and reported on, proposed boundaries described, sketch maps made and the position re existing native settlement investigated. The total area of these proposed forest reserves is 980 square miles (approximate).

Details are as follows:—

EXAMINED AND REPORTED ON BY FOREST OFFICER, SOUTHERN DIVISION.

(1) *Matandwe, Lower Shire District* (approx. area: 125 sq. miles).—A range of hills running along the Nyasaland-Portuguese border, north to south of district. The northern portion of the area is well covered with forest (open dry type). In the southern portion there is a considerable amount of native settlement and in consequence much denudation has taken place. All villages will have to remain in the reserve owing to lack of other suitable land to which to move them. Control of these will have to be strict. Re-afforestation is already being encouraged by the free distribution of plants from two forest nurseries established in the district.

(2) *Cholo Mountain, Cholo District* (approx. area: 24 sq. miles).—Comprises the upper slopes of Cholo Mountain, which are fairly well covered with forest, including the species “mlombwa,” “msopa,” “msuku” and a certain amount of “mbawa.” There are three villages on the area which cannot be moved owing to lack of alternative sites, as the Cholo District consists mostly of private estates. The natives will be controlled and they have agreed to participate in a scheme of afforestation.

(3) *Chiradzulu Mountain, Chiradzulu District* (approx. area: 12 sq. miles).—The slopes have been almost completely denuded of forest by natives in the making of gardens in the past, and soil erosion has been very great. The forest officer reports: "Owing to the congested state of the district, chiefly due to influx of Angwara, only a small area of the mountain could be recommended for demarcation as a reserve, for the natives have nowhere to move their gardens. The reservation of this part at least is necessary if the water supply of the district is to be maintained. The stream banks are fairly well covered and include a considerable number of mbawa trees."

(4) *Liwonde Hill, Liwonde District* (approx. area: 100 sq. miles).—Comprises the range of hills running in an easterly direction from the Zomba-Fort Johnston road. The forest officer reports: "The area is well covered with tree growth and very little damage has been done by the natives who have gardens on the top of the range. On the northern side the soil is very sandy and carries almost pure acacia type of trees, but on the southern and higher side the soil is heavier and such types as mchenga, mfunguti and a few mbawa appear."

AREAS EXAMINED BY FOREST OFFICER, NORTHERN DIVISION.

(5) *Mungochi Hill, South Nyasa District* (approx. area: 125 sq. miles).—The area is mountainous and forms an important watershed. Parts of the area are well covered with tree growth containing a large proportion of the more valuable species. Reservation is contemplated, and is hoped to eventually remove nine villages from the area when reserved.

(6) *Namizimu, South Nyasa District* (approx. area: 250 sq. miles).—The area comprises the range of hills at the south-east corner of Lake Nyasa running north and south between the lake shore and the Nyasaland-Portuguese border. In addition to being a watershed of some importance, the proposed reserve contains a good proportion of some of the best timber trees in the country, viz., mlombwa, nkongomwa, ntangatanga, etc. At present natives from Portuguese Territory are addicted to coming over the border into this area and clearing large areas of valuable timber high up the hills in making their gardens, which they only occupy for a year or two and then abandon. It is expected to be possible to move some of the existing villages from the area.

(7) *Pirolongwe Hills, South Nyasa District* (approx. area: 50 sq. miles).—A small watershed of importance in the western portion of the South Nyasa District. There is no native settlement in the area.

(8) *Mwai, Ncheu District* (approx. area: 30 sq. miles).—A small watershed including the Mwai and Sanjiki Hills. The forest has been largely denuded in the past and there are 22 villages on the area which cannot be moved. If reserved, control would be difficult; but it would seem to be the only means available in an attempt to prevent total denudation of this important watershed.

(9) *Dzonje Hill, Ncheu District* (approx. area: 18 sq. miles).—Partially denuded of tree growth. Native settlement consists of only three villages situated near the proposed eastern boundary of the reserve. Arrangements are being made for the removal of these.

(10) *Chingoni, Dedza District* (approx. area: 116 sq. miles).—It comprises the main watershed of the Dedza portion of the Angoniland Plateau, and is the only portion of the latter which still retains a covering of forest. The latter is generally of poor quality, lacking in the more valuable timber species, the general growth being inferior. Reservation is considered to be essential in connection with water supply and the prevention of soil erosion. There are about thirty villages within the area, but it is considered that most of these can gradually be moved.

(11) *Escarpment, Dedza District* (approx. area: 50 sq. miles).—This area is situated on the escarpment forming the eastern edge of the Angoniland Plateau. Reservation would be more or less experimental with the following objects in view:—

(a) To prevent further encroachment down the slopes (at present estimated at about 200 yards per annum).

(b) To observe the effect of reservation in the upper half of the area (situated on the plateau), which has already been denuded of tree growth, and in particular to ascertain the type and value of natural regeneration from stools, etc.

(c) To impress villages on the plateau in the Benbenke section (where the rate of deforestation is greatest) the necessity of establishing village forest plantations to supply their own requirements of poles and fuel.

(12) *Mchinji Hills, Fort Manning District* (approx. area: 50 miles).—The area comprises the Mchinji Hills, running in a north-westerly direction from Fort Manning Boma close to the Nyasaland-Northern Rhodesian border. It is an important watershed and is well covered with forest of the type usual to the country, viz., open dry forest consisting of small deciduous broad leaved trees. In the neighbourhood of the River Liwelezi, however, the forest assumes a good quality and contains a proportion of valuable species of good dimensions. At present there is a tendency for natives from Northern Rhodesia to encroach into this area and destroy the tree growth in making gardens. There are seven small villages in the area which will gradually be removed.

(13) *Nchisi Mountain, Kota Kota District* (approx. area: 30 miles).—Nchisi Mountain is the northernmost and highest peak of a range of hills running from Kota Kota District southward through the Dowa District, at a distance of about twenty miles west of Lake Nyasa. The River Lilulwa and its tributaries arise in the area. Although the range of hills is comparatively treeless Nchisi Mountain still retains a fair covering of forest, mostly of the ordinary open dry type. There is, however, at the summit and on the south-east face of the mountain, about three-quarters of a square mile of rain forest of a type and quality exceptional to this country, and containing a few

species of trees (broad-leaved) not commonly seen elsewhere. These contain valuable timber, the boles often attaining a height growth of 80 to 100 feet. Within the proposed reserve there are 17 villages (340 huts). These are to be allowed to remain for the time being under the necessary restrictions appertaining to demarcated forest.

(14) *White Rock (Lake Shore), South Nyasa District.*—A small area of 230 acres was provisionally demarcated for afforestation in connection with providing fuel supplies for the lake steamer traffic.

In addition, reports were submitted by the Forest Officer, Northern Division, containing a certain amount of general data with regard to the distribution and quality of forest tracts in the following districts: South Nyasa, Ncheu, Dedza, Lilongwe, Fort Manning and Dowa.

3.—DEMARCATATION.

Very little demarcation of boundaries was possible throughout the year due to lack of funds for the purpose.

4.—SURVEYS.

No survey of forest tracts was undertaken either by the Lands Office or the Forest Department. The only area surveyed to date is the Kanjedza Reserve (Blantyre District), an area of 512 acres demarcated for afforestation.

5.—WORKING PLANS.

A rough working plan was drawn up for the management of the Mudi eucalyptus plantations, Blantyre District. The area of 128 acres was divided into ten annual coupes for working on a ten-year rotation under a system of clear felling with regeneration by coppice.

A preliminary planting plan was submitted for the establishment of fuel plantations on the shore of Lake Nyasa in the South Nyasa District. The main object of the scheme is the provision of fuel for the lake steamer traffic although the possibility of it being decided to make Pagonas the terminus of the new lake railway has not been lost sight of. The plan takes into account 44 acres of existing young plantations and provides for the eventual establishment of a total of 200 acres of forest plantations. These will be worked under a pure coppice system on a ten-year rotation, the regular annual coupe to be 20 acres. The plans have been approved and adopted, and a reserve for afforestation formed at White Rock (Ndala Macumba) on the south-eastern shore of the lake. Revision of plans may be necessary if it is decided to make Pagonas the terminus of the new railway; also, it may be found advisable to reduce the rotation to less than ten years.

6.—COMMUNICATIONS AND BUILDINGS.

An earth road was made in the Mudi plantations to enable ox-carts to enter the felling area for extraction of timber and firewood. Several new roads were made on Mlanje Plateau and the main track down the Likabula Valley was improved to facilitate timber transport down the mountain. All paths on Zomba Plateau were hoed and maintained. Several minor repairs were effected on the forest officer's house at the Bar, Fort Johnston.

7.—PROTECTION OF FORESTS.

GENERAL.—Much destruction of forest appears to be still going on throughout the country, chiefly due to the almost universal system of native shifting cultivation and also fire. Under the provisions of the Forests Ordinance, 1911, natives are only restricted as regards undemarcated forest, in so far that they must not cut certain reserved trees or trees growing within 30 yards of any stream or river or eight yards of any public road. Control, therefore, is very difficult, and the staff of forest guards as at present sanctioned is totally inadequate to effect this. Not only must the native staff be increased but it seems that some restriction will have to be placed on the exercise of the native concession with regard to free cutting. Forest reserves are being created as rapidly as possible, but means for their complete protection are not yet available. In the matter of denudation of hillslopes, it is impracticable owing to the hilly nature of the Protectorate to declare and demarcate all of these; therefore it has been urged that district administrative officers deal with the matter under the powers provided by the District Administration (Native) Ordinance, i.e., for native gardens to be removed below a certain line which would have to be defined for each individual hill.

There appears to be a gradual diminishing in the movement of natives, and it is realised that by attaining their fixed settlement and thus replacing shifting cultivation by a system of permanent agriculture, an important step will have been taken in forest conservation.

CONVICTIONS FOR FOREST OFFENCES.

Mlanje District.—One European in this district was fined £1 plus royalty for cutting an mbawa without a permit. An Indian was fined £1 plus royalty for cutting poles without a permit. An Indian was fined £1 for grazing cattle on Crown Land without a licence. Nineteen natives in this district were fined 3s. each (the maximum) for cutting reserved trees.

Blantyre District.—An Indian was fined £1 and 5s. costs for cutting firewood on Crown Land without a licence. An Indian was fined 10s. for grazing cattle on Crown Land without a licence.

Chiradzulu District.—An Indian was fined in this district for cutting poles on Crown Land without a permit.

Liwonde District.—Two natives were fined 3s. each for cutting reserved trees.

Zomba District.—Several natives were convicted and fined for cutting in the Zomba Mountain Forest Reserve. Several natives were also fined for cutting in plantations and for stealing stacked firewood.

Note.—It is probable that there have been other convictions for forest offences in various districts which have not yet been reported to the Forestry Department.

FIRE PROTECTION.—A total area of about 2,500 acres of forest, comprising all plantations and the indigenous cypress woods on Mlanje Plateau, were protected by means of hoed and burnt fire-lines. This was successful with one exception, namely, the burning and destruction of a seven-acre young cypress plantation in the Likabula Valley, Mlanje Mountain. In this case fire was carried over the hoed fire-belt by a high wind during the night of the 26th September. Fires passed generally through all other forest, whether reserved or otherwise.

The nature of the climate favours the spread of fire which originates in all parts of the Protectorate, due to the custom of the native population in annually firing the dry grass, either preparatory to the making of gardens or in connection with hunting game and vermin, or for other purposes. The forests are almost without exception of the open dry type, and isolation by means of fire-lines cannot be undertaken to any extent on account of the cost of such operations. Even were it possible to effect such protective measures the native has yet to be educated as to the meaning, use and sanctity of forest reserves. In several reserves, in spite of all possible precautions being taken and surrounding villages warned, fires in several cases were started actually within their boundaries, but in no case could the culprits be traced. The introduction of legislation would appear to be necessary, making it an offence for any person to allow a fire kindled in the open to go beyond his control. Such legislation, supported by publicity and propaganda through the native chiefs and headmen, would no doubt tend to suppress the evil. Co-ordinated action in the matter would be necessary on the part of the administrative, police and forest department.

ANIMALS.—A certain amount of damage was caused by bush buck in young cypress plantations on Zomba Mountain.

DOMESTIC STOCK.—A small amount of damage was caused by trespass of native-owned goats into a plantation on the Zomba-Blantyre road.

INSECTS.—Some young cupressus plants in the Kanjedza Plantation were killed by an insect pest eating through the plant-stem just above ground level during the first few weeks after planting. Search has been made, but a specimen of the insect has not yet been found for identification. On the same area some of the young *Cedrela toona* have also been damaged by insect attack. In this case the leading shoot dies off through the cambium having been eaten through, several inches down the stem. A species of Scolytid beetle was found on one plant which may be the cause of the damage. Termites (white ants) continued to kill out tress in the eucalyptus plantation on the Zomba-Blantyre road (Ntonya). In the case where one or two individual young *Cedrela toona* plants were attacked by termites it appeared that these were damaged in the first place through some other agency. No case has yet been reported of *Cassia siamea* having been attacked by this pest.

FUNGUS DISEASES.—In the Zomba Plateau plantation of the pure *Widdringtonia Whytei* (Mlanje cypress) a few trees continue to succumb to a fungus disease which has the appearance of *Armillaria mellea*. Infected trees were felled, their stumps dug out and the immediate areas isolated by trenches one foot deep. Areas so cleared and isolated the previous year were planted up with *Cupressus torulosa*.

8.—NATURAL REPRODUCTION.

Natural regeneration is generally lacking throughout all indigenous forests - apparently due, for the most part, to destruction by fires which annually pass through them. On a few small areas which have been protected from fire there is invariably fair natural regeneration of msuku and one or two other species. On river-banks where mbawa, mwenya, ntangatanga and other species of timber size are to be found, it would appear necessary to both fire protect and also to keep clear of grass and weed growth for a few years in order to produce suitable conditions for natural regeneration. Close observation and experiment are necessary to ascertain suitable measures to aid reproduction of the more valuable species which are to be found in natural forest, but suppression of fire is considered to be a first essential.

9.—SOWING AND PLANTING.

(PLANTING SEASON 1922/23).

Zomba.—Nurseries were maintained at Bwaila, Ntonya and on Zomba Plateau. At the Arboretum, Bwaila, small plots of the following species were planted: *Cassias siamea*, *marginata*, *nodosa*, *fistula*, *grandis* (Ceylon seed); *Cedrela microcarpa*; *Araucaria braziliensis*; *excelsa*. On Zomba Plateau 22 acres were planted up with Mlanje cypress and *Cupressus lusitanica*. At Ntonya (6 miles from Zomba) 15 acres were planted with *Cedrela toona* and 5 acres with *Cassia siamea*. Extensive re-planting was necessary in areas afforested in the previous planting season, due to a large percentage of failures in consequence of the prolonged drought.

Mlanje.—On Mlanje Mountain 27 acres were planted with *Widdringtonia Whytei* (Mlanje cypress). In refilling gaps in previous plantings 13,850 plants were used, the majority being *Cupressus torulosa*.

Fort Johnston.—Nurseries were maintained at the Bar, Dimba and Namweras. Experimental planting was continued over a total of 62½ acres. At Dimba (Pamalombe) and other places along the banks of the River Shiré, a large percentage of the transplants failed to establish themselves, and in spite of repeated plantings the areas were eventually very badly gapped. On the lake shore at the Bar and at White Rock (30 acres) results were much better, and it has now been decided to restrict operations to the latter area in the future. The species used were *Cedrela toona*, *Casuarina equisetifolia*, *Eucalyptus saligna*, *E. rostrata*, *E. tereticornis*, and *Cassia siamea*. Experiments are being made in the cultivation of various indigenous species.

Blantyre.—The Mudi nursery was maintained and new nurseries were formed at Namame and Kazungu (near the Kanjedza Reserve). During the planting season 1922/1923 90 acres of the Kanjedza Reserve were planted up with *Cupressus torulosa* and a few plots of *Callitris robusta*. *Cedrela toona* was planted as a belt (consisting of three rows) around the edge of each block as a fire-protective measure in addition to the roads and rides. Only *Cedrela toona* plants were available in the Mudi nursery (the only one at that time established), therefore all the cypress plants had to be supplied from the Zomba nurseries. The percentage of failures amongst these was very high and except in one block where the soil is better than the average, the results were most disappointing.

General.—Nurseries were maintained at Chiradzulu and Port Herald for the raising of plants for free distribution to natives. A new nursery for this purpose was formed at Dowa.

Area of Plantations.—No survey has been made of plantations and the total afforested area can only be computed from estimates and notes made in past years. These indicate the approximate total area to be about 1,030 acres:—Zomba Plateau (coniferous), 410 acres; Mlanje Plateau (coniferous), 136 acres; Zomba District (broad-leaved), 320 acres; Blantyre District (broad-leaved), 128 acres; South Nyasa District (broad-leaved), 44 acres.

Tending Operations.—Cleaning and thinning operations were carried out in various plantations. With the exception of at Mlanje Plateau, a satisfactory price was realized for all thinnings, there being a certain native demand in Zomba and Blantyre for even the smallest sized poles.

10.—SEED AND PLANTS.

SEED.

Collection.—Seed of many exotic species was collected from plantations at Zomba, Blantyre and South Nyasa. Seed of certain indigenous species was collected, including Mlanje cypress seed from Mlanje Mountain.

Purchases, etc.—Seed purchases were made from the Forestry Departments of South Africa, Ceylon and India and various exchanges of small quantities were effected.

Sales.—Sales of seed to the public during the financial year 1922/23 realized £43 18s. 9d.

Free Issues.—Samples of seed issued to the public and to district stations amounted to 23 lbs.

PLANTS.

Sales to the public (year 1922/23) realized £67 16s. 6d., there being a greatly increased demand for *Cedrela toona* plants.

Free Issues.—Gratis issues to Government departments totalled 28,000 plants. The total number of plants issued gratis to natives during the planting season 1922/23 is estimated at 200,000 as follows: From Zomba nurseries, 16,631; Mlanje nurseries, 33,228; Blantyre nurseries, 15,022; Chiradzulu Nurseries, 105,000; Port Herald and other stations, 30,000 (estimated).

11.—RESEARCH.

Up to the present no research has been possible. Technical notes are now to be made by officers when in the field, chiefly on the following points:—

- (a) The raising of indigenous and exotic species under varying conditions;
- (b) Their rate of growth;
- (c) Their silvicultural requirements, regeneration, etc;
- (d) Their immunity from attack by termites, etc.

12.—EXPLOITATION.

By DEPARTMENTAL AGENCY.

Timber.—Systematic exploitation by the Forest Department of the patches of cypress forest on Mlanje Mountain was continued. Cutting is being limited to the requirements of the Public Works Department and operations are carried out under a clear-felling system involving the replanting of cleared areas. This is considered the cheapest and most efficient method of regenerating the forest. Any of the recognised systems of management involving natural regeneration are out of the question in the case of this type of forest, and unfortunately it cannot be worked with a view to obtaining a sustained yield of timber for the following reasons:—(a) The smallness of the aggregate area of the scattered patches of forest, which are limited to ravines and gullies; (b) The cypress forms only a proportion of the growing stock, the other trees being small broad-leaved species of practically no value, with a sprinkling of podocarpus which attains only small dimensions; (c) The cypress are mostly mature or over-mature trees.

From January to December 1923, a total of 22,422 cubic feet of sawn Mlanje cypress timber were turned out from the sawpits at a cost of £535 9s. 7d., or 5.75d. per cubic foot. In addition, 23,925 shingles were adzed from waste timber at a total cost of £17 5s. 6d., or 1s. 2d. per 100. During the year 19,670 cubic feet of sawn timber were transported by carriers from the sawpits on the Plateau to the timber depot at the base of the mountain at a cost of £436 16s. 8d., or 5.33d. per cubic foot.

Poles and Firewood.—A total of 25 acres of eucalyptus plantations at Blantyre, Zomba and Fort Johnston were clear cut by the department under the provision of plans for the management of the plantations under a pure-coppice system. Part of the produce was sold to the public and the remainder issued to the Public Works Department at a nominal charge. Extensive thinnings from the Zomba Plateau cypress plantations and others were similarly

disposed of. Timber, poles, firewood and bamboos were cut from other Crown Forests by the Public Works and other departments under their own agency, free permits first being issued by the Forestry Department and as much control as possible exercised.

BY GENERAL PUBLIC.

No concessions were applied for or granted, all exploitation being carried out by means of permits and licences. In the case of timber the permittee is granted a tree under a rough selection system. This he fells, and the tree is then measured by a forest guard. Royalty must be paid before sawing operations are commenced, when a transit pass is issued to allow of the removal of timber from Crown Land. Permits for river-bank trees are being limited to fallen, dead or over-mature trees. Permits for poles and firewood only allow the cutting of unreserved species.

FREE GRANTS.

- (a) Free grants of produce are made to all Government departments.
- (b) The native population can, under the present Forests Ordinance, cut without restriction in any unreserved Crown forest with the exception of certain reserved species, or trees growing within 30 yards of any stream or within eight yards of any public road.

The annual consumption of free produce by natives is estimated to be: poles 2,000,000 and bamboos 6,000,000, firewood 120,000,000 cubic feet. In addition a considerable area of forest is annually destroyed chiefly due to shifting cultivation.

MINOR PRODUCE AND GRAZING.

In the past the collection of *Landolphia* rubber and *Strophanthus* seed was a regular industry, but during the last two years this has been entirely neglected, due, apparently, to the fall in the market price of these products.

Beeswax is collected by natives for sale to local traders; this does not pay royalty. The weaving of mats from palm leaves for local trade is carried on to a small extent by natives in localities where palms are plentiful. In some of the northern districts of the Protectorate natives still utilize fibre from the bark of certain trees for the manufacture of "bark cloth" clothing, bags, string, etc. Canoes in the form of hollowed-out tree stems are made near the shores of Lakes Nyasa and Chilwa and also along portions of the River Shiré. Grazing on Crown Land was mostly carried on under licence involving a fee per head of animals. In the northern districts a few grazing leases were granted.

STATEMENT SHOWING OUTTURN OF PRODUCE (YEAR 1/4/22 TO 31/3/23).

Produce Sold.	Quantity.	Revenue.
Indigenous timber and poles	36,300 cubic feet	£ 1,060
" firewood	9,428 cubic yards	589
" bamboos	54,200	68
Plantation poles	7,740	161
" firewood	1,668 cubic yards	209
Total		<u>£2,087</u>

FOREST PRODUCE EXEMPTED FROM ROYALTY.

(a) Government Departments—

Output of sawn cypress timber for Public Works Department during the financial year 1/4/22 to 31/3/23, 25,111 cubic feet. Net value at 2s. 6d. a cubic foot				£3,140	
Mbawa timber	3,800 cubic feet (log measurement)			190	royalty value.
Other species timber	2,460	"	"	52	do.
Poles	1,090	"	"	28	do.
Bamboos (small)	32,000	"	"	40	do.
do. (large yellow)	1,216	"	"	25	do.
Firewood	18,000 cubic yards (estimated)			1,125	do.
Total				<u>£4,595</u>	

(b) Native Population (Estimated)*

Timber (Poles)	2,000,000	£25,000	royalty value.
Firewood	120,000,000 cubic feet	277,000	
Bamboos	6,000,000	7,500	
		<u>£300,500</u>	

* These figures are based on a total of 340,000 huts as per tax returns, estimating a renewal of huts involving fresh poles every fifth year. The fuel figure is based on a consumption per hut of slightly less than one cubic foot per day. The consumption is probably much more than this, and no account is taken of destruction.

13.—FINANCIAL RESULTS.

A statement of revenue and expenditure appears in Appendix 1. The total revenue collected did not come up to expectations owing to general financial stringency throughout the year. The figure £589 in respect of indigenous firewood, as compared with £706 in 1921/22 and £1,218 in 1920/21, indicates considerably less cutting of fuel from Crown Lands by the railway company. The £370 realised for plantation produce is gratifying when compared to a total of £259 realised in the previous year and £184 in 1920/21. There has also been a considerable increase in respect of grazing fees and the sale of plants and seed. For analysis of revenue showing amounts collected in districts in respect of the different classes of produce, see Appendix 2.

14.—ADMINISTRATION.

European Staff.—Mr. J. M. Purves, Chief Forest Officer, proceeded on leave on the 11th May and eventually retired on pension on the 19th December. Mr. J. B. Clements assumed the duties of Chief Forest Officer on the 1st May and was confirmed in that appointment on the 19th December. Mr. J. E. A. Carver, forest officer, retained charge of the Northern Forestry Division (provisional) throughout the year with his headquarters on the lake shore near Fort Johnston. Mr. R. G. Ross Townsend, forest officer, was posted in January to the Southern Forestry Division (provisional) with his headquarters at Limbe. Mr. C. G. Searle, forester, remained in charge of exploitation operations (Government timber supply) and afforestation on Mlanje Plateau.

Subordinate Staff.—The native staff consists of five native foresters (only partly trained), 20 forest guards, three native clerks and a messenger.

15.—LABOUR.

No difficulty was experienced in getting labour in the Zomba and South Nyasa districts. There was difficulty in obtaining sufficient labour in the Blantyre District, and the natives available had to be paid a food allowance, whether local boys or from up country. At Mlanje ample labour was available for work on the plateau. The usual difficulties were experienced with regard to carriers for timber transport down the mountain, owing to the unpopularity of the work. In spite of offering to each carrier completing his contract a blanket, a waterproof cape and a cash bonus of 2s. in addition to the already high rate per trip plus food given during the year, no less than 191 carriers recruited from up country deserted soon after arrival at Mlanje. A system of cash payment for single trips whereby the carrier is not bound beyond the one load down the mountain is proving successful and every endeavour is being made to advertise and develop the scheme.

16.—GENERAL.

Imports of Wood.—Timber imports for the year were valued at £3,535 as compared to a value of £395 in 1922, or to an average of £380 for the three years 1920 to 1922—an increase of nearly tenfold.

Advice on Tree Planting.—Requests for advice on tree planting continue to increase. In this connection inspections of private plantations were undertaken by officers whenever possible. The Chief Forest Officer read a paper at the agricultural conference held in Blantyre in August.

Planting in Forest Reserves.—During the year natives residing in the locality (but outside the boundaries) of the Zomba and Kanjedza Forest Reserves evinced a wish to make gardens on denuded areas within these reserves. This was allowed on the natives agreeing to plant trees supplied from our nurseries between their crops during the following rainy season. A permit containing the agreement was given to each headman concerned. At the commencement of the rains the natives came in for plants as agreed by them.

J. B. CLEMENTS, B.Sc.,
Chief Forest Officer.

30th March, 1924.

APPENDIX I.

FINANCIAL STATEMENT (1st April, 1922, to 31st March, 1923.)

EXPENDITURE.			RECEIPTS.		
	£	s. d.		£	s. d.
(a) Personal emoluments ...	2,333	10 0	I. <i>Cash Revenue.</i>		
(b) Travelling expenses ...	210	4 5	(a) Indigenous timber		
(c) Passages ...	286	4 11	(including poles)	1,059	16 3
(d) Afforestation ...	661	6 0	(b) do firewood ...	598	4 4
(e) Tools, seeds, books and			(c) Bamboos ...	67	14 7
incidentals ...	76	11 1	(d) Plantation poles ...	161	3 8
	£3,567	16 5	(e) do firewood ...	208	9 3
			(f) Grazing fees ...	195	2 2
			(g) Sale of plants and seed	111	15 3
				£2,393	5 6
			II. Value of forest produce		
			supplied to Government		
			Departments (exempted		
			from payment) ...	4,595	0 0
				£6,988	5 6
			Value of estimated native		
			consumption of free		
			forest produce ...	£309,500	0 0

See paras. 12 and 13 of Report.

ANALYSIS OF FOREST REVENUE COLLECTED DURING FINANCIAL YEAR 1ST APRIL, 1922, TO 31ST MARCH, 1923.

Station.	Indigenous Produce.			Grazing Fees.		Parkland Produce.		Sale of plants and seed.		Total.
	Timber, including poles.	Firewood.	Bamboos.	£	s. d.	Poles.	£	s. d.	£	s. d.
Zomba (collected by C. F. O.)	597 16 2	215 19 2	27 11 3	38	8 0	159 3 2	208	9 3	111 15 3	1,854 2 3
Ft. Johnston (by F. O., N. Divn.)	161 1 9	109 11 0	36 8 4	19	16 0	2 0 6	—	—	—	928 17 7
Port Herald, by Resident	31 18 8	115 13 4	10 0	43	16 0	—	—	—	—	191 18 0
Dowa	61 4 2	19 7 0	—	42	8 0	—	—	—	—	122 19 2
Dedza	50 7 9	24 4 6	12 6	4	18 0	—	—	—	—	80 2 9
Chintechi	43 7 1	1210 0	5 0	—	—	—	—	—	—	56 2 1
Lilongwe	31 4 7	7 4 0	—	16	13 4	—	—	—	—	55 1 11
Fort Manning	22 5 6	5 18 9	—	26	0 10	—	—	—	—	54 5 1
Ncheu	43 6 2	7 5 0	2 5 0	—	—	—	—	—	—	52 16 2
Blantyre	—	27 17 9	—	—	—	—	—	—	—	27 17 9
*Mlanje	1 7 10	17 5 10	—	—	—	—	—	—	—	18 13 8
Kota Kota	1 0 0	8 8 0	—	8	2 0	—	—	—	—	17 10 0
*Chiradzulu	4 2 0	9 3 0	—	—	—	—	—	—	—	13 5 0
Mzimba	6 17 11	4 13 0	—	—	—	—	—	—	—	11 10 11
Liwonde	3 16 8	4 4 0	2 6	—	—	—	—	—	—	8 3 2
	1,059 16 3	589 4 4	67 14 7	195	2 2	161 3 8	208	9 3	111 15 3	2,393 5 6

* With the exception of the issue of firewood licences in these three Districts, permits generally were issued and controlled from Headquarters, Zomba.

CHEMISTRY.

The work continued from the previous year was connected most largely with :—

I.—Tobacco Soil Survey, including (a) field work on soil types ; (b) soil analyses ; (c) observations on production of tobacco on the soil types and the varieties of tobacco suited to these types.

II.—Tobacco Investigations and Field Experiments intimately connected with the above, including (a) Manurial experiments on estates with different types of soil ; (b) Seed-bed soil investigations ; (c) Curing ; (d) Chemical investigations on tobacco. Experiments on manuring and rotations with cotton have also been started in connection with the above, with the kind co-operation of the Magomero Estates.

III.—Advisory work on tobacco culture and diseases, including (a) visits to planters' associations and individual estates ; (b) publications of articles in the *Nyasaland Times* ; (c) issues of circulars and leaflets. Subsidiary work mostly carried out during the dry season was connected with (a) cattle dips, suspected cases of poisoning, etc. ; (b) milk analyses ; (c) water analyses ; (d) analyses of limestones, burnt limes, coals and other minerals ; (e) fertilizer analyses ; (f) native poisons.

I.—TOBACCO SOIL SURVEY.

(a) FIELD WORK.

Field work with tobacco has necessarily occupied a large part of my time as no one else has been available for the large amount of district work involved in these investigations. Assistance at estate experiments has also been given as far as possible in measuring plots, sowing manures, and harvesting and keeping plot-yields separate.

(b) SOIL ANALYSES.

The new laboratory was entered on February 1st, 1923. My previous statements on the correlation between mechanical analyses by the method I have found most suitable for tobacco soils and the type of tobacco produced have been confirmed.

It is easy, of course, to say on the results of American soil survey the ideal soil for the production of bright tobacco should be composed of about 70 per cent. of fine sand, together with 6 to 8 per cent. of clay, besides silt and organic matter ; but as far as I have ascertained no such soil exists in Nyasaland where tobacco is successfully grown. The characteristics of Nyasaland soils are the high percentage of coarse sand and the amount of colloidal iron contained in the clay. It is quite clear, however, that while some Nyasaland soils approximate very closely to the heavy manufacturing tobacco types, other resemble the Virginian brights. Other Nyasaland soils again may be called intermediate, in that in some years they will produce a heavy bodied leaf while under different climatic conditions leaf most suitable for flue-curing. On soils with a high percentage of nitrogen and potash, however, such as type G exemplified in the table, the production of dark-fired tobacco should always be attempted, and the methods of increasing and maintaining fertility for the production of such tobacco should be adhered to. On soil type A, giving a tobacco most suitable for flue-curing, it is folly to expect that such a type will produce dark tobacco with success, even with very low topping and selecting very few leaves. Soils whose texture shows them to be suitable for the production of "Burley" tobacco are very general.

The triangle method of Whittles (*Journal of Agricultural Science*, 1922) for plotting tobacco soils and sub-soils of Nyasaland brings out well the differences in the mechanical composition of those of Nyasaland and America. The method of the Soudan Tropical Laboratories has proved itself a quick and accurate method of determining the type of tobacco which should be aimed at on the soils of Nyasaland ; and, moreover, from such analyses can be correlated certain physical properties of these soils. It should be realized that there is a great diversity of soils in Nyasaland, and even on one estate soils of the types 388, 390, 392 and 380 are found. It does not mean that types are found only in the districts in which samples have been taken. In examples, type A is found all over the Shiré Highlands.

The table below represents mechanical analyses of a few typical soils, the samples of which have been carefully taken by myself with the auger.

Tobacco Soil Type ...	...	A. For Bright Tobacco.		B.	C.	Inter- mediate Types.		E. For Dark.	G.
No. of Sample ...	...	372	523	388	439	463	701	380	703
District ...	...	Zomba	Mlanje	Zomba	Cholo	Cholo	Limbe	Zomba	Cholo
SOIL:—									
Coarse gravel, above 3 mm. diam. ...	...	.62	12.5	.03	Nil	.25	Nil	.07	.2
Fine gravel, 3 mm. diam. ...	...	10.2	14.3	5.2	4.4	7.9	5.7	2.9	5.6
Coarse sand, 1-0.2 mm. ...	...	50.7	35.2	43.2	40.7	40.0	34.6	32.4	19.7
Fine sand, 0.2-0.04 ...	...	25.9	31.2	28.9	19.2	16.8	21.6	18.5	14.9
Silt, 0.04 to 0.01 mm. ...	...	3.7	6.3	8.7	8.0	12.7	9.9	8.5	9.6
Fine silt, 0.01-0.005 ...	...	.3	1.6	1.1	6.7	4.8	4.8	1.3	1.0
Clay, below 0.005 mm. ...	...	9.3	11.4	12.9	20.9	17.8	23.3	36.8	49.1
Hygroscopic moisture ...	...	1.7	2.4	1.3	1.5	1.3	1.7	1.7	3.4
Organic matter ...	...	2.9	4.6	4.5	7.5	6.6	8.2	7.9	12.2
including NITROGEN ...	...	.036		.06	.104	.106	.136	.074	.164
SUB-SOILS:—									
Coarse gravel ...	...	.96	2.4	.02	.06	.09	.19	.02	.3
Fine gravel ...	...	17.8	11.6	5.4	4.7	6.6	4.9	4.1	2.8
Coarse sand ...	...	48.5	35.4	40.8	47.0	26.6	23.2	30.8	16.8
Fine sand ...	...	16.9	31.2	24.7	14.3	16.1	20.5	18.1	11.9
Silt ...	...	3.3	3.2	7.5	8.7	7.9	4.9	5.0	8.0
Fine silt ...	...	.4	2.9	.9	3.7	4.8	1.5	2.9	1.1
Clay, below 0.005 mm. ...	...	13.1	15.7	20.8	31.5	38.0	41.1	39.2	59.4
Hygroscopic moisture ...	...	1.3	2.1	1.6		1.9		1.3	5.0
Organic matter ...	...	3.1	3.9	4.2		6.7		7.7	10.5

Chemical analyses of typical representatives of the various soil types are seen in the following table. The analyses of the soils on which experiments have been carried out during 1923, and which are referred to subsequently, should be particularly noticed.

TYPICAL SOIL TYPE ANALYSES.

District ...	Z	Mik.	Z	Z	C	Z	L	Z	B	Mla.	Chir.
Tobacco Soil Type ...	A	A	B	C	C	D	...	E	E	F	G
Reference Number ...	372	495	388	392	439	386	701	380	589	526	235
1923 Experiment ...	Expt.	...	Expt.	...	...	Expt.	...	Expt.	...	...	Expt.
Loss on Ignition ...	2.93	3.4	4.49	6.34	7.52	6.92	8.22	.788	7.8	11.85	12.49
including Nitrogen ...	.036	.048	.06	.093	.104	.096	.136	.074	.097	.14	.18
Potash ...	.195	.201	.25	.28	.41	.27	.31	.76	.38	.38	.41
Available potash ...	.021	...	.018	.020	.054	.022	.0195	.036	.0195	...	.058
Phosphoric acid ...	.106	.207	.09	.10	.11	.22	.12	.219	.08	.132	.125
Available phosph. acid ...	.011	...	.032	.037	.006	.0165	.0245	.024	.018	...	.025
Carbonates ...	trace	.06	.10	.07	.07	trace	trace	.04	.09	trace	.04
Calcium oxide ...	.13	.43	.11	.15	.09	...	...	.43	.15	.11	...
Iron oxide ...	5.33	8.20	5.2	4.72	3.42	...	...	6.1	6.28	6.5	...
Alumina ...	6.56	6.20	5.2	7.1	5.87	...	...	9.8	6.51	6.2	...
Manganese oxide ...	.12	.08	.04	.025	.07	...	...	.05	.09	.02	...
Magnesia ...	.08	.35	.13	.197	.13	...	...	.15	.21	.213	...
Lime requirements ...	.024	.05	.07	.115	.12	.105	.112	.17	.154	.19	.074

(Hutchinson-McLellan method.)

C=Cholo. Z=Zomba. Chir.=Chiradzulu.
L=Limbe. Mik.=Mikalongwe.
B=Blantyre. Mla.=Mlanje.

The following figures of production of various grades for three years on an estate (where soils of the types 388, 390 and 392 are found) will show that the yields of each individual year vary somewhat, but that the preponderating grade is always produced provided that topping and priming of the plant is uniform each season. It is understood that topping and priming can be so carried out that the preponderating grade can be altered, but not *always* with distinct success in the production of good qualities.

PERCENTAGES OF GRADES.

Year.	Brights.		Lugs.		Semi-Brights.		Dark Mahogany.		Darks.
1921	...	17	...	21	...	46	...	10	5
1922	...	6	...	7	...	75	...	10	2
1923	...	3	...	14	...	63	...	11.5	7.5

The following salient features of Nyasaland soils have been brought out in analyses :—

- i. The high percentage of coarse sand.
- ii. The organic matter bears a relationship to the finest particles below .005 millimetres in diameter. These, of course, by our method also contain the soluble and colloid humus.
- iii. The nitrogen is proportional to the organic matter provided the soil occurs on similar elevations and is subject to similar climatic conditions.

This is seen in the analyses of soils lying alongside one another, as in the following table, the difference being due to removal of humus and finer particles by erosion.

	Organic matter.		Nitrogen.	
At low levels	Soil A	541	9.88	.189
	Soil alongside A		2.04	.035
At high levels	Soil B	761	7.85	.109
	Soil alongside B		9.44	.213

- (iv) Few soils contain more than 1 per cent. of carbonates calculated as carbonate of calcium (lime).
- (v) Calcium, magnesia, and the alkali metals are, however, found as silicates, and the percentage of them is seen to be fairly high.
- (vi) Oxides of metals such as iron, aluminium, titanium and zirconium in combination are found as high percentages in the Shiré Highland soils. Iron and aluminium hydrides often occur in the free state with considerable influence on the properties of the soil. The mineral acidity is very low.
- (vii) Manganese is the usual small percentage of about .05.
- (viii) These oxides cause the soils to have a very low lime requirement, which, moreover, bears a relationship to the organic matter.
- (ix) Chlorine only occurs as a trace in most soils of the Shiré Highlands (c.f., water analyses).

It is necessary to draw attention to the dangers of soil erosion in the Shiré Highlands. It is useless to give advice on the management of many tobacco soils if such are continually being washed. Planters are, however, adopting measures for prevention, and it is encouraging to see that from the way some estates are now being farmed there are not so many people who are merely desirous of exploiting the soil capital for their own immediate benefit.

Requests for advice on management of soil types were sent in from 65 estates during 1923. While it is endeavoured to give as reliable information as possible, it is impossible always to obtain representative samples of fields and fully analyse all samples sent in. It has been possible, however, to obtain much information on the management of these tobacco soil types and of the crop itself. Methods of improving yield and quality of this crop are indicated in these investigations.

1 (c).—TOBACCO VARIETIES FOR THE VARIOUS SOIL TYPES.

The tobacco soil survey gave more definite information on the type of soil suited to the growth of certain types of tobacco. Much work yet remains to be done, however, on varieties of tobacco suited to the different types and on the acclimatization of those varieties. The practice of buying seed from other countries is to be deprecated not only because the variety is often unsuited to the type of soil but also because of the introduction of diseases which often become much more dangerous than in the country of their origin.

It is impossible even after all the years tobacco has been grown in Nyasaland to state definitely the best variety for each type, although for the lighter types "Gold Leaf" after acclimatization appears to be far the best. Many varieties have been tried on numerous types of soil in Nyasaland. For the production of heavy-bodied leaf suitable for fire-curing, "Big Orinoco," "Little Hill," "Lacks," "Rich Wonder," "Blue Pryor" have not been a distinct success. "Blue Pryor" seems to have obtained a poor reputation owing to disease attacking this variety severely on certain estates in 1923, but from observations on certain types of soil the variety warrants further trial. It has been the practice in past years to condemn a variety on a trial of one year and probably on a soil unsuited to it and before the variety has been acclimatized. It is observed that very often better and more healthy growth is obtained from seed harvested in the second year of introduction, and that a leaf more suitable for its purpose is produced if the soil conditions are beneficial. "One Sucker" is a variety which seems suitable for growth on old land where the sub-soil showed it to be suitable for dark tobacco production.

"White Burley" varieties for the production of air-cured leaf will grow well on a wide range of soils provided the lime-requirements are low, and the reports from England show it to be little inferior to American "Burley" in quality. It is far superior to most other Empire-grown air-cured tobacco. The comparatively recent introduction of these "Burley" varieties warrants further trial and investigation. "Turkish Leaf" is only grown to a very small extent in Nyasaland and then only for home consumption.

II.—TOBACCO INVESTIGATIONS.

Tobacco Investigations have mainly taken the form of experiments on the various soil types. It is proposed eventually to issue leaflets on the management of each soil type on the results of experiments and the data of the soil survey.

EXPERIMENT A.—VARIETY: "WHITE BURLEY" TOBACCO.

Plot.	Manuring per acre.	Yield in lbs. per Acre.	Increase in lbs per acre over average no manure.
1. ...	200 lbs. sulphate of potash ...	489	—
2. ...	Nil ...	735	—
3. ...	100 lbs. sulphate of potash ...	645	96
4. ...	Nil ...	567	—
5. ...	60 lbs. sulphate of potash ...	642	98
6. ...	60 lbs. do. and 100 sulphate of ammonia	531	decrease 18 lbs.
7. ...	100 lbs. potash and 50 lbs. ammonia	636	87
8. ...	100 lbs. potash and ammonia 100	543	decrease 6 lbs.
9. ...	Nil ...	540	—
10. ...	Complete manure 300 lbs. per acre.	669	120
11. ...	Nil ...	354	—
	Average of no manure plots ...	549	—

Analysis of 300 lbs. of complete manure showed 60 lbs. water soluble phosphoric acid, 30 lbs. potash, 2½ lbs. nitrogen.

Analysis of the soil (No. 235) is shown above. It is thus seen that a soil in this stage of fertility is not likely to react to fertilization, with the possible exception of water soluble phosphoric acid. Data on residual value will be collected during 1924.

EXPERIMENT B.—NAMIWAWA GOVERNMENT FARM.

Great hopes were entertained of this experiment. It was arranged on the chess-board system and it was intended to carry out observations on the same piece of land for several years. Such complicated experiments are only possible on Government stations where it is intended to work out the nutritional balance for the tobacco plant on different types of soil and to obtain information on all the following points:—(a) Incidence of disease under different manurings; (b) Improvement of qualities of tobacco, the percentage of different grades being worked out for each plot; (c) Profit accruing either in grade or increased weight. Chemical investigations would determine the improvement in qualities.

The plantings were rather late owing to only one set of nurseries being available which were arranged primarily for seed selection. Swarming caterpillars on the 10th January did considerable damage but the superintendent eventually managed to get a fair stand and at harvesting time he carefully counted the plants on each plot so that the error was reduced considerably. It will be noticed from the plan that the yield of the no-manure plots decrease in certain directions, which can be traced to the damage done in the young plants by the caterpillars invading the garden from the side 19-20, but were checked before reaching plots 1 to 6. The harvested tobacco was fire-cured.

The plan of the experiment was as follows, each plot being square:—

24	18	12	6
23	17	11	5
22	16	10	4
21	15	9	3
20	14	8	2
19	13	7	1

EXPERIMENT B.—NAMIWAWA.

Plot.	Application per acre.	Calculated yield fire-cured leaf per acre.	Inc. or dec. over adjacent no manure plots.	Inc. or dec. over average no manure.
	lbs.	lbs.	lbs.	lbs.
1 ...	200 superphosphate	608 ...	180 inc. ...	171 inc.
2 ...	50 amm., 100 superphosphate	623 ...	115 „ ...	191 „
3 ...	nil	574 ...	—	—
4 ...	50 amm., 50 lbs potash	612 ...	115 „ ...	180 „
5 ...	nil	442 ...	—	—
6 ...	100 amm.	510 ...	68 „ ...	78 „
7 ...	100 superphosphate	522 ...	187 „ ...	90 „
8 ...	nil	423 ...	—	—
9 ...	50 potash 100 lbs superphosphate	461 ...	21 dec. ...	29 „
10 ...	nil	475 ...	—	—
11 ...	50 amm.	532 ...	74 inc. ...	100 „
12 ...	100 „ 100 lbs potash	488 ...	38 „ ...	56 „
13 ...	nil	348 ...	—	—
14 ...	50 potash, 50 lbs superphosphate	402 ...	1 dec. ...	80 dec.
15 ...	nil	456 ...	—	—
16 ...	100 potash, 50 lbs amm.	497 ...	8 inc. ...	5 inc.
17 ...	nil	458 ...	—	—
18 ...	50 amm., 150 lbs potash	468 ...	10 „ ...	36 „
19 ...	50 potash	362 ...	5 dec. ...	70 dec.
20 ...	nil	386 ...	—	46 „
21 ...	100 potash	367 ...	22 „ ...	65 „
22 ...	nil	326 ...	—	116 „
23 ...	150 potash	375½ ...	16½ „ ...	56½ „
24 ...	200 potash	499 ...	41 inc. ...	67 inc.
	Average yield of no manure plots.	432 ...	—	—

Superphosphate, sulphate of ammonia and potash were the only manures available.

Careful study of the results show that the decreases in column 4 are not so great as at first sight as the yield of the no manure plots are less than the yield of the manured plots adjacent to them.

Analysis of the results show that potash by itself is not profitable while phosphates and small dressings of ammonia are profitable: this is to be expected by the analysis of this soil No. 380. (See above tables.)

RESULT OF EXPERIMENT C.—VARIETY: GOLD LEAF.

On Soil No. 386.

No. of Plot.	Application per acre.	Flue-Cured yield per acre 1st Picking.	Air-Cured yield per acre 2nd Picking.	Total Yield
		lbs.	lbs.	lbs.
1 ...	200 lbs. sulphate of potash (K ₂ SO ₄)	160	88	248
2 ...	100 lbs. K ₂ SO ₄ , 50 lbs. ammonia sulphate	252	72	324
3 ...	Check	132	79	211
4 ...	50 lbs. K ₂ SO ₄ , 50 lbs. ammonia sulphate	169	67	236
5 ...	100 lbs. ammonia sulphate	84	152	236
6 ...	Check	88	112	200
7 ...	100 lbs. superphosphate	204	136	340
8 ...	100 lbs. K ₂ SO ₄	156	135	291
9 ...	50 lbs. K ₂ SO ₄	132	108	240
10 ...	100 lbs. K ₂ SO ₄ , 50 lbs. superphosphate	188	76	264
11 ...	Check	148	80	228
12 ...	50 lbs. K ₂ SO ₄ , 50 lbs. phosphate, 50 lbs. amm.	320	48	368

Late planted tobacco suffered from 10 days drought after planting. Average of no manure plots=213 lbs. per acre.

	lbs.	Value.	Cost.	Loss or gain
Increase due to 200 lbs. potash (K ₂ SO ₄)	35	26s.	40s.	14s. loss.
„ „ „ 100 „ „ „	78	58/6	20s.	38/6 gain.
„ „ „ 50 „ „ „	27	20s.	10s.	10s. „
„ „ „ 100 lbs. superphosphate	127	95/6	10s.	85/6 „
„ „ „ 50 „ „ and 100 K ₂ SO ₄	51	38s.	25s.	13s. „
„ „ „ Complete manure	155	116s.	30s.	86s. „
„ „ „ 100 lbs. K ₂ SO ₄ , 50 amm.	121	91s.	35s.	56s. „
„ „ „ 50 lbs. K ₂ SO ₄ , 50 amm.	25	18/9	25s.	6/3 „
„ „ „ 100 lbs. „ „ „	25	18/9	30s.	11/3 loss

In experiment C, the ripening effects of the phosphate applications are noticeable and the late maturing effect of the ammonia on No. 5 plot. Less disease was seen on the potash plots and the tobacco was superior to that obtained from the other plots in texture. No difference in fire-holding capacity was observed by tests with the lighter recommended by Nessler. This and the two following experiments were conducted on late tobacco. The total yields are seen to be very low, but if it is remembered that the average yield of Nyasaland tobacco is usually below

400 lbs. to the acre and that yields of 1,000 lbs. can be easily obtained on the heavier types of soil, it will be understood that these yields are not below the average for the later-planted tobacco, which is the cause of our total low average. It has been observed during 1923 that over a total acreage of 130 on one estate a yield of 20 tons was produced, but that when the yield of late tobacco per acre was calculated, it was found to be only 1 cwt. per acre over 40 acres. This gave the average yield over the first planted 90 acres as four hundred weight per acre in a bad year.

EXPERIMENT D.

Plot.	Application per Acre.	Yield per Plot.	Plot.	Yield per Plot.
No. 1—54 lbs. potash K ₂ O	...	159	No. 9—54 lbs. potash	114½
2—No manure	...	121½	10—No manure	87½
3—72 lbs. potash	...	104	11—72 lbs. K ₂ O	79
4—No manure	...	119½	12—No manure	78
5—90 lbs. potash	...	111	18—90 lbs. K ₂ O	78
6—No manure	...	118½	14—No manure	79½
7—108 lbs. potash	...	86½	15—108 lbs. K ₂ O	67
8—No manure	...	72½	16—No manure	64½
Total	...	892½	Total	642

Plots Nos 1-8 also received 100 lbs. nitrate of potash as a cross dressing. The potash described above was supplied by sulphate of potash (48 per cent.). Analysis of this soil 372 is seen in table above. Any profit due to the nitrate of potash was due to nitrogen alone. Sulphate of potash by itself has given no increase. There are obviously deficiencies in this soil of phosphates, nitrogen and lime. When these deficiencies are made up, potash dressings would be profitable. The cheapest way to renovate this land, which has been 10 years in cultivation without manuring, would be to grow velvet beans manured with phosphatic fertilizers and lime.

Plants attacked with eelworm were counted on plots 16, 15, 14 and 13.

	Plot 16	15	14	13
Percentages of badly attacked were	per cent. 12	per cent. 20	per cent. 10	per cent. 19
" " slightly " "	7	8	2.8	5
" " those not attacked or very slightly	81	72	86.7	76

Thus the small dressings of potash were of no use in combating eelworm as far as could be seen. The land had also been under maize three years previously.

On Soil No. 388. EXPERIMENT E.—VARIETY: "WARNE." Late Planted Tobacco.

No. of Plot	Applied in lbs/acre	Yield of green leaf.
No. 1	100 lbs sulphate of potash	1,212½
	60 " " ammonia, 80 lb superphosphate	
No. 2	200 " sulphate of potash	906
	60 " " ammonia	
	80 " superphosphate	
3	Check	1,080
4	100 lbs sulphate of potash	984½
5	Check	1,480
Weighings		Percentage sound tobacco of total dry weight of green leaf
1	108 lbs of sound cured and bulked tobacco	68
2	118½ " " " " " " " "	91.2
3	31½ " " " " " " " "	22.2
4	120 " " " " " " " "	93
5	78 " " " " " " " "	40

The factors limiting the yield of the plots in this experiment were: (a) Bad drainage and Excessive rain; (b) Disease attacking every plant.

11(b).—INVESTIGATIONS ON SEED-BED SOIL.

The production of strong, healthy plants for setting out in the field being one of the most important operations in tobacco culture, a few experiments have been made in the management of seed-bed soil. They have brought out the following points, which it is hoped to confirm as soon as the tobacco experimental station is in operation :—

1. Vegetation should not be dug into new beds but should be carefully removed, including the root systems. Maize grown on seed-bed soil is a useful rotation. Fallowing also assists in the elimination of eelworm and disease organisms.
2. The time of burning should give an interval of a few days before sowing of seed. Ashes should be well watered into soil.
3. Fertilization of nurseries is profitable. Not only is the supply of plants ensured but the type of plant is superior in root system and health.
4. Sowing with the watering-can method has proved itself by the following advantages:
 - (a) Quickness; (b) Even sowing in wind; (c) Soaking to hasten germination, (d) Washing directly after sterilization with no retarding of germination.

5. *Inspection of seed-beds* a few months after planting out will indicate whether eelworm or fenching has started there. These troubles often start from the seed-beds even if they are new.
6. *Area of seed-beds* which go to the planted acre vary in different districts and in each season. The minimum is 25 yards with intervals of sowing, although 12 square yards should easily give enough plants to the acre (if this one sowing gives plants coinciding with the planting rains); but the safest is 75 square yards. The optimum in late districts is 100 square yards.
7. *Spraying of nurseries* with Bordeaux mixture often stimulates growth to the same extent as two small applications of nitrate of soda. (One tablespoonful to 10 square yards in solution.)

Late nurseries are often neglected, which may influence the late planting considerably. Special methods, such as fertilizing and spraying, are of much more importance with these late nurseries than with the earlier ones. The long dry spell which is encountered before and during most of the seed-bed time should be noticed when comparing with American conditions.

11(c).—CURING.

Observations on curing were carried out at the estates on which experiments were made. It was evident that methods of curing very different to the normal should be adopted when very moist conditions prevail and when the harvested leaf is full of organisms such as those of our principal bacterial spot and *alternaria* fungus. The two latter are both capable of spreading pole-burn in the barn under moist conditions if special methods are not adopted. Quick cures, whether by flues or open fires, were essential, and even the best curers experienced pole-burn unless these were adopted. Although slightly more than the average of green leaf was obtained, owing to the killing of the enzymes or curing agents in the leaf before the colour was obtained throughout the barn, this is better than the many forms of pole-burn. In the extreme cases the midrib of the leaf became so involved that the leaf-blades were dropping away in large numbers, and it was almost impossible to save much tobacco from the totally infected barn.

(a) The method of curing recommended by Ragland (Virginia) was tried, and was superior to the ordinary cure with diseased tobacco. Briefly, this method consists in raising barn to 90 deg. Fahr. as soon as it is full of leaf. After three hours, the temperature is raised to 125 deg. Fahr., or as high as the tobacco will stand without scalding. After a few minutes the temperature is allowed to fall to 90° deg. again. This opens the cells and allows the water to come to the surface. The ordinary yellowing process at 95 deg. Fahr. is then continued.

(b) The above method is suitable for both fire and flue-curing; but when good bright tobacco is being attempted the following method may be adopted with less risk. It must be realized that leaf is often put into the barn looking quite clean, but in the process of a slow cure the characteristic black and brown spots appear which are due to the multiplication of the bacterium of the chief Nyasaland leaf-spot disease. The moist conditions are as much conducive to the spread of disease as to yellowing of the leaf. In this method the temperature of the barn is allowed to reach 95 deg. Fahr. in as short a time as possible. This temperature is retained about six hours and then, at about six-hour intervals, the temperature is increased by 5 degrees till 110 deg. Fahr. is reached. The yellowing is completed at this temperature.

In the process of fire-curing it was found that the temperature should not stay too long at 95 deg. Fahr. It is as essential, with this serious danger of pole-burn in fire-curing sheds, to observe the temperatures and the humidity as it is in the flue-curing barn. Ventilation should be very efficient in the later stages. The practice of using wet and dry bulb thermometers to observe accurately the humidity of the barn can be thoroughly recommended at all times. Wilting in the season under review was not often a success for the reasons stated above.

The production of substances in Nyasaland tobacco which give it its peculiar aroma is most probably the influence of soil constituents which have not hitherto been revealed by chemical analysis. I hope that heavy manuring with lime and cheap phosphates on certain soils may improve the aroma considerably.

III.—ADVISORY WORK ON TOBACCO CULTURE AND DISEASES.

Advisory work on tobacco culture has mainly taken the form of advice on soil management, and co-operative work carried out with the entomologist and superintendent of Namiwawa Farm. Costings were especially studied, as it can easily be seen that special methods which we recommend may influence the profit to a great extent.

It will be seen in the following observations during the season 1922/23 that precautions and measures for combating disease are connected with drainage, ordinary treatment in the nursery and the field, the "physiological or nutritional balance" of plant food, and special methods, such as spraying and seed disinfection.

Drainage.—Land on which disease had attacked the tobacco severely has been found to be water-logged at a short depth. Such conditions are predisposing to fungus and wilt diseases. A healthy growth means that the plant can withstand the inroads of disease and often outgrow them. It is apparent in this country that more attention should be paid to drainage.

Topping and Priming.—As has been shown by Fromme and Wingard in Virginia, the severity of infection from disease is closely related to height of topping. With high priming and numerous leaves on the plant there was less disease than in an adjoining field with low priming and fewer leaves.

Turning over of Leaves by Wind.—Tobacco leaves have numerous hairs which prevent drops of rain and dew falling off readily if the leaf is turned over by wind, as often happens. These drops offer a medium in which the spores can successfully germinate and invade the stomata on the underside of the leaf. Such spots as subsequently occur are often put down to sunburn, but this is not the case.

Manuring.—During the partial drought of 1921-22 there was an accumulation of available nitrogen in the soil which gave in the early stages of the season 1922-23 a very good growth. If, however, the nitrogen was in excess there was less disease resistance, which was aggravated by the very wet condition which prevailed in the later stages of growth. Ripening was retarded. However, even if 50 lbs. of sulphate of ammonia or its equivalent does retard ripening by a fortnight, which has been observed on the red loams, such an effect is easily counteracted by dressings of high-grade phosphates at 100-200 lbs. per acre. It should be realized that there are yet some planters who do not know ripe tobacco when they have it in the field. This, of course, has an influence on the inroads of diseases, which are much more rapid in over-ripe tobacco. (As has been pointed out, the red loams with few exceptions are noted for deficiencies of phosphates and slow ripening.) Potash and lime showed up well in controlling the ravages of diseases, where there was good drainage and cultivation methods. The tobacco on the plots manured with lime in 1921 was more disease resistant than those alongside. The absence of disease on tobacco soils in which potash felspar or orthoclase was abundant was obvious.

From the information given by Wolf and Foster on tobacco wildfire, and Fromme and Murray on angular leaf-spot of tobacco, it seemed obvious that the leaf-spots occurring towards the end of January, 1923, were caused by bacteria in most cases. The appearances were similar to those of the angular leaf-spots; although later, owing to fungous diseases also attacking the same leaf, it was difficult to diagnose which organism caused the most damage. The fungous diseases of tobacco in the absence of a mycologist were ably dealt with by the entomologist.

It was possible at the beginning of the season 1923-24 to examine further the spots which appeared after a wet and dull spell of weather, and with the co-operation of the Chief Veterinary Officer cultures were made in the bacteriological laboratory. The organism from these spots is motile, of size 5μ by 1.5μ up to 2μ , and it is possible to demonstrate a capsule. The investigations are proceeding, but it seems that the Nyasaland leaf-spot is caused by a bacterium not identical with any of the American leaf-spot bacteria but very similar, and it is evident that similar control measures should be adopted. The totally different climatic conditions of Nyasaland should, however, be borne in mind, particularly the long dry season, in which soil inoculated with this organism in the previous wet season may become free from the disease. The dry time which is usually encountered during seed-bed time should also be borne in mind; the seed-beds during the dry October and November, 1923, remained very free from disease, although damping-off was seen in December.

With the above considerations in mind and in view of the results of the valuable work of the Government Entomologist on plant diseases, a tour was made of all the tobacco districts in the country during August and September, 1923, and demonstrations were given in disinfection of seed, spraying of nurseries and general methods of combating diseases. The retarding of germination which in a few cases could be definitely put down to the disinfection of seed some considerable time beforehand, but which in most cases could be traced to faulty technique or bad seed, can be easily eliminated if the seed is disinfected and then sown by the watering-can method as soon afterwards as possible, as recommended in our Circular No. 5 of July, 1923. Over 200 lbs. of seed was disinfected by the department with as short an interval before sowing as possible. Complaints were received by planters not attending these demonstrations. Practically all the seed supplied to natives in the Zomba district was sterilized by us. Their nurseries were good.

The following articles were published in the *Nyasaland Times*: (1) Notes on Curing Tobacco, (2) Lime and Tobacco, (3) Texture of Tobacco Soils, (4) White Burley Tobacco, (5) Application of Fertilizers, (6) Drainage, (7) Costings of the Tobacco Crop, (8) Curing of Diseased Tobacco, (9) Field Experiments, (10) Methods of Combating Diseases, (11) Soil Erosion.

The following publications have been issued in connection with tobacco investigations: Circular No. 3 of 1923, "Manuring of the Tobacco Crop"; Circular No. 5 of 1923, "Management of Seed-bed Soil"; Leaflet D, "Value of Manures"; Leaflet E, "Management of Soil Type A."

SUBSIDIARY WORK DURING 1923.

Dips.—The usual supply of deci-normal iodine for testing of dips has been made to the officers of the Veterinary Department together with other reagents. Stomach-contents of cattle dying from various causes have been tested for the quantity of arsenic which the Rhodesian Agricultural Department recognise as causing death. Two positive and two negative results were obtained.

Milk samples tested have shown the usual high percentage of fat when the samples are properly taken and the milk has not been tampered with. Fourteen samples have been tested. The small percentage of solids (not fat) should be noted; it is only to be expected when the wide nutritive ratio of the average feed of Nyasaland cows is considered. The average of correct samples this year gave 4.63 per cent. of butter-fat and 8.04 per cent. of solids not fat.

Water.—The standard for water analysis in the Shiré Highlands has been taken as the Mlungusi source. Several samples have been analysed during the dry season. As might be expected the chlorine is very low in the uncontaminated streams and springs from the mountains of these formations, and it never exceeds 10 parts per million (c.f., soils.) Ammonia is always

low from these sources, rarely exceeding .003, and albuminoids rarely exceeding .01 parts per 100,000. Oxygen absorbed gives a figure which is, of course, exceedingly useful in tracing contamination in water from planters' wells. Alkalinity is very low in these waters.

STANDARD, Mlungusi Source:—Turbidity and colour, crystal clear; odour, faint peaty reaction, slightly alkaline; free and saline ammonia, .003; organic ammonia, .01; chlorine, .15; nitrous nitrogen, .005; alkalinity, .125; oxygen absorbed, .0135; Total solids, 2.6. Appearance on ignition, very slight charring; phosphates, very faint trace; examination of sediment, slight vegetable debris.

Minerals.—Limestones have received most attention as a source of lime for tobacco soils. Pure Iceland Spar has been found on an island in Lake Shirwa, but most limestones in the Port Herald, Mwanza, and Liwonde districts contain magnesia in varying amounts. Advice was given in the burning of lime at Port Herald, and it was possible to obtain a lime having the following composition, which is as satisfactory an agricultural lime as is possible under the conditions: Insoluble matter, 3.25 per cent.; alumina, etc., 2.48; caustic lime, 58.61; magnesia, 12.89; carbon dioxide, 6.59; total lime, 67 per cent. Six local limes from various sources were found satisfactory for making Bordeaux mixture when the ordinary rate for 4-4-50 solution is increased to 4-6-50.

Nine coal samples submitted by the geologist gave ash-percentages varying from 21.2 and 3.73 up to 59.4. A salt-bearing earth from the Chundisa-Mbuzi road was found to contain 14.8 per cent. of bi-carbonate of soda, which is surprising when it is considered how few alkali soils there are in the Shiré Highlands. A sample of river silt gave the following analysis: nitrogen, .323 per cent.; potash .32 and phosphoric acid .47 per cent. (soluble in hydrochloric acid). The experiment at Namiwawa in 1922, showing great increase in maize yield on land manured with such silt, should be remembered in this connection.

Fertilizers, insecticides, etc.—Few complaints can be made concerning the quality of these substances, although the price was often excessive. A fertilizer delivered as nitrate of potash was found to be sulphate of potash with no trace of nitrate. A sample which was stated to be 90 per cent. sulphate of potash (K_2SO_4) was found to contain 88 per cent. A sample of lead arsenate was found to contain 28.5 per cent. arsenic oxide (As_2O_3), which is satisfactory. A mixed fertilizer was found to have the following composition: ammonia, 5.22 per cent.; potash, 37.8 per cent.; phosphoric acid, .73 per cent. This was apparently made up as follows: sulphate of ammonia, 21.3 per cent., sulphate of potash, 71.8 per cent., superphosphate of lime 4.5 per cent. The superphosphate of lime should be in excess of the other salts for a tobacco fertilizer for most Nyasaland soils.

Poisons.—The following native products have been forwarded, although little can be done on them owing to the amount of work required on our most important crop:—(a) Velvet bean varieties (poisons in seed-coats); (b) "Mwonga" bark; (c) Nsima or porridge suspected to contain poison; (d) "Luvungwe"; (e) "Mkundi" roots and pods. Most of these have been tried on small mammals in co-operation with the veterinary officers. (b) "Mwonga" caused brief pain and distension of the abdomen but no death. (c) The nsima caused death of one kitten but not of another. (d) "Luvungwe" is a compound used to cause abortion. One woman had evidently taken an overdose, but the particular "active principle" has not been isolated. Investigations will proceed on these substances whenever possible.

A. J. W. HOENBY,
Agricultural Chemist.

ENTOMOLOGY.

Travelling.—During the year the amount of travelling undertaken has been less than normal. Altogether some 8,300 miles have been covered, chiefly during the wet season; at the beginning of the year in connection with experimental work at Nampawa; towards the latter end of the year investigating a reported discovery of pink bollworm on cotton in Portuguese Territory near Mlanje and, at the request of the Chief Veterinary Officer, an outbreak of trypanosomiasis among cattle at Chiromo.

Collections.—Collecting has been chiefly confined to species of economic value, and much of this work has been devoted to the rearing of crop pests and the preservation and mounting of their immature stages. Some 500 specimens have been added to the general and economic collections, which have also been re-arranged. Lack of space has handicapped the formation of well-displayed collections, but the arrival of a consignment of new store-boxes will render part of this work easier in the future. More accommodation is badly needed, however, before the collections warranted by the insect fauna of the country can be adequately housed, and the funds allotted only allow of very slow progress in this direction. Only the best procurable cabinets and store-boxes are of value in a tropical climate, and such are very expensive; but it is a waste of time to attempt to preserve insect specimens under any other conditions.

Literature.—Cataloguing has been reduced to a minimum by the adoption of a filing system whereby all entomological pamphlets are collected under subject headings, as foreshadowed in my last report. There still remains, however, a vast amount of work to be done in the way of indexing valuable papers contained in publications of a general scientific and economic nature. Such work, despite its importance, is quite beyond the time at my disposal. The more important serial works dealing with entomology have been bound: a few of the most recent publications, and the missing parts in valuable works of reference have been obtained by purchase.

Publications.—Towards the middle of the year the regular fortnightly contribution of popular articles to the local press was found to be impracticable, and papers were therefore rendered as subjects warranted. An article on Swarming Caterpillars on Tobacco, a series of four papers on Coffee Pests and Diseases and a short account of the Pink Bollworm situation, were the most important contributions thus published. On the other hand, the publications issued by the Entomological Division were more numerous than heretofore, and consisted of the following:—

Bulletin No. 3. "Plant Diseases."	Leaflet C. "Eelworm or Root Gallworm."
Circular No. 2. "Spraying Tobacco Seed-beds."	" F. "Poison Baits."
" No. 4. "Tobacco Beetle."	" G. "Arsenical Sprays"
Leaflet A. "Sterilization of Tobacco Seed."	" H. "Paraffin Emulsion."
" B. "Fumigation with Hydrocyanic Acid Gas."	" J. "Tobacco Extract."

With the exception of of Leaflets H and J distribution of all these publications was made to Planters Associations and elsewhere. During the year Circular No. 4 and Leaflets A, B and C were reprinted. The distribution of such publications has been received in most quarters with enthusiasm, and by means of these pamphlets the correspondence of the division has been considerably reduced. Similar pamphlets dealing with the more important pests of various crops are in preparation. It is abundantly apparent that practical interest concerning the control of insect pests has been aroused among the planting community as a result of these publications.

Plant Importations.—Over one hundred packages have been dealt with. In only one case was fumigation necessary. One package of seeds was destroyed as it had been wrongly declared.

Legislation.—The proposed ordinance concerning plant importations and the control of insect pests within the Protectorate, submitted in January, was revised later in the year and should come before the Legislative Council early in 1924.

Mycological and Bacterial work.—This work was carried on during the year, but it was arranged that the Assistant Director would undertake this branch on his return from leave. The early part of the year was characterized by serious attacks of plant diseases on tobacco, as was to be expected from the conditions prevailing towards the end of 1922. Wildfire and Angular Leaf Spot were prevalent, but by far the worst trouble was due to "Alternaria" Rust. The destructive severity of these diseases was probably due to the prevailing climatic conditions immediately prior to harvesting the tobacco, and in addition planters were not in a position to take adequate precautions against such an outbreak, the first of its kind known in Nyasaland. In view of the nature of the diseases responsible for this destruction, a vigorous propaganda on sterilizing seed and spraying seed-beds was instigated for the season 1923-24, and in conjunction with the Agricultural Chemist a demonstration tour throughout the planting districts was arranged to explain seed sterilization and the preparation and use of Bordeaux Mixture. In

addition a large quantity of seed was sterilized in the laboratory at Zomba, and individual journeys were undertaken to demonstrate the use of spraying machines. It was clearly shown during this work that a large quantity of poor seed had been circulated throughout the country.

It was only to be expected that any poor seed-beds would at once be blamed to the sterilized seed, and many erroneous and exaggerated reports were circulated to this effect. Delayed germination was the most usual complaint, but wherever the facts could be traced, it was usually found that insufficient washing after sterilization, some other default in the recommended method, or poor seed was the cause. Nevertheless, it seems probable that the better treatment of seed-beds, or at least the employment of means whereby diseases can be combated at any early stage, have gained a footing as regular cultural practice.

Insect Pests.—General enquiries concerning insect pests have been for the most part normal. The chief trouble has been due to Nyerere ants on tobacco seed-beds, swarming caterpillars on tobacco and cotton, and bollworm. These are dealt with under the respective crop sections

A—COTTON.

BOLLWORM.

The 1922-23 season was exceptionally bad with bollworm, and many crops were practically ruined by this pest. As much time as was possible was devoted to research work in the field and to statistical work in the laboratory. The latter was sorely needed to throw light on the seasonal prevalence of the bollworm, and thanks to the ready co-operation of the A. L. Bruce Estates, Ltd., The Blantyre & East Africa, Ltd. (Mlosa Estate), The British Central Africa Company (Mitoli Estate) and their respective estate managers upon whom devolved considerable extra work—to whom my grateful thanks are due—a continual weekly supply of buds, flowers and bolls was available for laboratory study between March and July. Altogether some 24,000 flowers and bolls were examined during this period and some interesting figures were obtained.

In the first place the valuable information was elicited that, in spite of the apparently enormous degree of overlapping of the different broods during the season, as is shown in the field by the simultaneous presence of all stages of the insect, there is a distinct rise and fall in the visible amount of bollworm attack coincident with a rise and fall in the percentage of full-fed bollworms found at any specified time. Consequently, it is possible to define with a certain amount of accuracy the periods when an individual brood, or the major portion thereof, is just commencing, or vice versa, nearing completion of the larval life.

In the second place it is clearly indicated from the figures obtained in this work, that the later broods have a higher percentage value than the earlier ones.

From a consideration of these facts it is clear that "handpicking" as a control for bollworm can only be of value if organised to coincide with the seasonal history of the pest. A concentrated campaign of "handpicking" at the very beginning of the season, to catch the first brood, will be of more value than spreading out the labour so as to have gangs working continuously. In the latter case the labour might always be working through a field just after a brood had completed the larval life, and there would only be small caterpillars present which are easily overpassed. In addition, any reduction of the first brood must automatically mean a reduction in all the succeeding broods.

Experimental field work was carried out at Namiwawa between February and April, and although it was not possible to complete all the experiments proposed, certain definite results were obtained. It was found that trap-cropping with maize, various species of hibiscus, and chickpea had no influence on the bollworm attack. Spraying experiments were commenced but had to be abandoned owing to lack of time, and attention was therefore concentrated on the experiment of removing all first buds and young bolls from a plot of cotton, in the hope of reducing the first brood of bollworms by depriving them of their normal abundant food supply. This experiment, although conducted on a very small scale, gave most encouraging results. The percentage infection on the experimental plot never rose above 21.75 per cent. of infected bolls, whereas the control plot showed 49.75 per cent. infection on the same date; also the percentage infection of the control plot never fell below 23 per cent., which was at the beginning of the experiment when the percentage infection of the experimental plot was only 12 per cent. At the end of March climatic conditions made the work of counting the infected bolls extremely difficult, and lack of intelligent assistance prevented the continuance of the experiment.

Taken in conjunction with the statistical results this work strongly supports the theory that bollworm must be controlled by reduction of the first brood. The concentrated campaign of handpicking referred to above might well be replaced by this removal of the first crop of young bolls and buds.

It is intended to carry out further experimental work on these lines during the coming season. The possibility of trap-cropping with early sown cotton will also be investigated on a fairly large scale.

PINK BOLLWORM.

In October a report was received that pink bollworm (*Platyedra gossypiella*, Saunders) had been located in cotton grown by the Empresa Agricola d'Ile (Alto Lugella) in Portuguese Territory only a few miles from the Mlanje border. Permission was obtained from the Portuguese Governor at Quelimane for investigation of this cotton to be made, and a preliminary search

was made in the native cotton-growing area of Linguni, with negative results. Early in November the search was carried into Portuguese Territory, with the able assistance of Mr. C. B. R. King, the entomologist of the Empire Cotton Growing Corporation. No trace of pink bollworm could be found, nor was there any evidence forthcoming that the report was justified. Correspondence with the entomologist at Lourenço Marques received no reply, but information was received later (January, 1924) from the Chief of the Division of Entomology, Pretoria, to the effect that investigations in the Portuguese cotton areas at Chiromo and on the Zambezi did not produce pink bollworm, and that other erroneous reports of the presence of pink bollworm in the same area had been made at various times in past years.

B—TOBACCO.

The usual pests, such as cutworms and defoliating caterpillars, were noticed, but the most serious damage was caused by swarming caterpillars and Nyerere ants.

NYERERE ANTS.

The activities of this pest are confined to the seedbeds at a time when the seed is on the point of germinating. Owing to their enormous numbers these ants are capable of removing so much seed from the areas sown that germination is practically negligible. It would seem that the drought of 1921-22 has had considerable influence on the distribution of this pest, as although it appears similar destruction has been noticed in past years, the information available points to it as being of a spasmodic and uncommon nature. The Nyerere ant is one of the semi-graminivorous type, and the drought year probably induced migrations towards the moist areas of the river banks where tobacco seedbeds are always situated. On coming in contact with the abundant seed supplies thus rendered available the graminivorous nature of the ants would be at once enhanced to the obscuration of their more general scavenger behaviour. If such migrations occurred on a large scale, which is by no means impossible, it will of course take a considerable time before the "balance of nature" adjusts itself. The difficulty in dealing with this pest lies in the fact that the ants do not manifest themselves until the seedbeds are watered, by which time the seed has already been sown. It was demonstrated, however, that by broadcasting a poison bait over a moist seedbed some two days prior to sowing the ants could be checked, though in this particular case seed had already been once removed.

SWARMING CATERPILLARS.

There was a somewhat general outbreak of swarming caterpillars on tobacco and cotton early in the year. The caterpillars were noticed first, chiefly on tobacco, and this was followed by reports of flights of butterflies having been seen at an earlier date in the same areas. It was assumed on somewhat scanty evidence, with the idea of preparing planters for similar outbreaks, that there was direct connection between these phenomena. But this turned out to be totally erroneous. The swarms of caterpillars consisted mainly of *Caradrina exigua* and *Prodenia littoralis*, whereas the species forming the swarms of butterflies consisted for the main part of *Catopsilia florella*.

The caterpillars were checked by means of trenching and the dusting of paris green, and in one very severe case spraying with lead arsenate was carried out.

This latter was a most valuable and instructive proceeding, from the point view of economic entomology, as it was possible to obtain definite figures proving that even in Central Africa the cost of spraying in the field is not prohibitive nor even excessive when the success of the modern method as opposed to the total failure of the archaic practices hitherto employed in the country for the control of a serious pest are compared.

The occurrence of these swarming caterpillars is of a spasmodic nature, and the explanation of this particular outbreak is that at the critical time of the season when labour was most required for cleaning the fields prior to planting, labour supplies were extremely scarce. It followed that when planting weather arrived all available labour was set to plant. In all cases where swarming caterpillars were subsequently noticed it was found that, owing to this fact, the "Bunongwe Weed" in the vicinity and on the edges of planted fields had not been removed prior to planting. When the planting of the tobacco was completed the labour was then put on to hoe up the weed. "Bunongwe" is known to harbour a large number of different leaf-eating caterpillars, and those forming the swarms were among them. When the weeds were hoed under in the usual manner these caterpillars at once transferred their attention to the tobacco.

CUTWORMS.

As suggested in my last report, the reduction of the cost of poison bait for cutworms was obtained by the substitution of a cheap grade of molasses for the sugar hitherto used as the sweetening material. Thirty-five 8-gallon drums of molasses were obtained from the Sena Sugar Estates, and were put on the market at 18s. per drum. The demand, however, was not as large as anticipated, but the material will keep. The stocks of poisons held in the country were also very small, and this may account to some extent for the increased usage of the bait being less than was expected.

TOBACCO BEETLE.

Fumigation with hydrocyanic acid gas was carried out in several cases, but the construction of estate buildings makes this work very difficult to accomplish satisfactorily. Towards the middle of the year a consignment of liquid hydrocyanic acid was obtained from South Africa, and was used on two occasions in October and November. This method of fumigation, though rather dangerous, particularly in the hot weather, was infinitely superior to the use of cyanide with acid, and was also considerably cheaper.

C—TEA.

Few enquiries regarding tea pests have been received during the year under review. A consignment of tea seed was sterilized with a weak solution of copper sulphate (1 per cent.) at Blantyre for the B. and E. A. Company.

D—COFFEE.

It was established that cutworms attack young coffee plants in this country as elsewhere. As indicated in my last report endeavour was made to procure stem shields that would protect the plants from this pest, and sample shields, as used in Kenya, were obtained from the Dux Chemical Solution Company, and these were distributed for trial to coffee planters. Arrangements were made with the Customs authorities to allow the importation of these shields at a minimum rate of duty, and it is to be hoped that advantage will be taken of this concession.

E—MAIZE.

The erection of air-tight storage tanks continues in a desultory fashion. The enormous loss suffered through the use of native "nkokwes" is still ignored to a very large extent, partly because the cost of the tanks still remains extremely high. The stock of carbon bisulphide in the possession of the department after the famine of 1922 was, as suggested in my last report, put on the market at 12s. per gallon, and fifty gallons have been disposed of in this manner.

Miscellaneous.—Various other subjects have been dealt with as time permitted, among which the destruction of white ants and the prevention of bees swarming in houses have received attention. Unfortunately, owing to lack of facilities for experimental work and the great call on my time of the more pressing problems has not allowed of much progress to be made in these directions. At the end of November, a week was spent at Chiromo investigating a suggested presence of tsetse fly following on a severe outbreak of trypanosomiasis among cattle in this area. Fly, however, was not found, and the disease would appear to have originated elsewhere.

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